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CIVIL ENGINEERING.

*On the Preservation of Timber by Creosote.**

Wood may be briefly stated to be composed of a fibrous tissue, which, upon examination with the microscope, is found to consist of longitudinal tubes, arranged in concentric rings around the centre pith;—these tubes varying in diameter from $\frac{1}{200}$th to $\frac{1}{200}$th part of an inch. The use of these tubes in a growing tree is to convey the sap from the root to the branches; and after the tree is cut up for use, they contain the chief constituent of the sap, vegetable albumen, a substance very much resembling in its composition animal albumen, or the white of an egg. Different woods vary in the proportion which they contain of this substance; but in the softer woods it averages one per cent.

The dry rot in timber is caused by the putrefaction of the vegetable albumen, to which change there is a great tendency; and when once this has taken place, it soon infects the woody fibre, inducing decomposition, and causing its entire destruction. Many plans have been employed to arrest this evil, each with more or less success,—the chief aim of the authors being to coagulate the albumen by means of metallic salts, and so prevent putrefaction. Among others may be mentioned the following, as being the most successful:—Kyan's process, by the use of chloride of mercury; Burnett's, by chloride of zinc; and Payne's, by sulphate of iron and muriate of lime, forming an insoluble precipitate in the pores of the wood. To each of these plans there are serious objections in practice. In the first place, when metallic salts are injected into timber in sufficient quantities to crystallize, the crystals force open the pores, causing a disruption of the fibre; and when the timber afterwards becomes wet, they dissolve, leaving large spaces for the lodgment of water, and rendering the timber much weaker. Secondly, the metallic salts being incapable of

* From the London Journal of Arts and Sciences, December, 1851.

sealing the pores of the wood, the fibre is still exposed to the action called eremacausis—a process of oxidation—after the albumen has been precipitated. These processes are also objectionable for wood that requires iron to be inserted in or attached to it, as the acids act upon the iron in a manner well known, and ultimately destroy it.

The plan that is the subject of the present paper is the one invented by Mr. Bethell, for the use of a material obtained by the distillation of coal tar. This material consists of a series of bituminous oils, combined with a portion of creosote: which latter substance is acknowledged to possess the most powerful antiseptic properties. The action of the material may be thus described: When injected into a piece of wood, the creosote coagulates the albumen, thus preventing the putrefactive decomposition; and the bituminous oils enter the whole of the capillary tubes, encasing the woody fibre as with a shield, and closing up the whole of the pores, so as entirely to exclude both water and air. The bituminous oils being insoluble in water, and unaffected by air, the process is thereby rendered applicable to any situation. So little is bituminous oil affected by atmospheric change, that the writer has seen wrought iron pipes that had merely been painted over with it, and laid in a light ground, one foot beneath the surface, taken up after twenty years, and they appeared and smelt then as fresh as when first laid down.

By using these bituminous oils, the most inferior timber, and that which would otherwise soonest decay, (from being more porous, and containing more sap, or being cut too young, or at the wrong season,) is rendered the most durable. This will be readily understood when it is considered that this porous wood will absorb a larger portion of the preserving material than the more close and hard woods: in fact, the soft woods are rendered hard by this process. By this means, therefore, engineers will be enabled to use a cheaper timber with greater advantage than they could use a more expensive timber uncreosoted; thus, taking the cost of a sleeper of American yellow pine at 4*s*., and one of Scotch fir at 3*s*., and then adding 1*s*. to the latter for creosoting, the two would be the same cost; but the former one would last, under the most favorable circumstances, not more than ten or twelve years; and the other would be good, under any circumstances, in all probability in a hundred years.

This system of preserving timber has been in use on several railways, and other works, for several years past. A portion of the London and North Western Railway, about seventeen miles in length, has been laid with the creosoted sleepers from nine to eleven years; during which period the engineer reports that no instance has occurred in which any decay has been detected in them, and they continue quite as sound as when first put down. On the Stockton and Darlington Railway, creosoted sleepers have also been laid for ten years, and are found to continue without any appearance of change or decay; also, on the Lancashire and Yorkshire Railway creosoted timber has been used for five years, as paving blocks, posts, &c.; the upper part has become very hard, and the part under ground appears as fresh as when taken out of the creosote tank, though the timber was of inferior, sappy quality. In a trial, commenced twelve years since, by Mr. Price, of Gloucester, of the comparative durability of timber in the covers of a melon pit, where it was exposed con-

stantly to the combined action of decomposing matter and the atmosphere, the unprepared timber became decayed in one year, and required replacing in a few years; a portion of the timber that had been Kyanized lasted well for about seven years, but then very slowly decayed; while the timber that had been creosoted still continues as sound as when first put down.

Not only does this creosoting process render wood free from decay, but it also preserves it from the attacks of the teredo worm, when used for ship building, harbors, docks, and other work contiguous to the sea. This has been satisfactorily proved at Lowestoft harbor, where the plan has had a very extensive trial for four years; and the superintendent reports that the uncreosoted piles have all been attacked by the limnoria and the teredo to a very great extent, and in some instances are eaten through; but there is no instance whatever of a creosoted pile being touched, either by the teredo or the limnoria; and all the creosoted piles are quite sound, though covered with vegetation, which generally attracts the teredo. This is to be accounted for by the creosote remaining intact in the timber, either wet or dry; and, being destructive to all animal life, it is proof against the attack of these parasites; whereas, with the other processes, the metallic salts are washed out, or that portion which unites with and coagulates the albumen is rendered quite innocuous by the process.

There are two processes in use by Mr. Bethell, for impregnating timber with creosote. One is by placing the wood in a strong iron cylinder, and exhausting the air from it, by an air pump, until a vacuum is created, equal to about twelve pounds on the square inch; the creosote is then allowed to flow into the cylinder, and afterwards a pressure is put upon the creosote, by a force pump, equal to about 150 pounds on the square inch; and the timber, on being taken out, is fit for use.

The second process consists in first placing the timber in a drying house, and passing the products of combustion through it; thereby not only drying the timber rapidly, but impregnating it, to a certain extent, with the volatile oily matter and creosote contained in the products given off from the fuel used to heat the house. When the timber is taken out of this house, it is at once immersed in hot creosote in an open tank, thus avoiding the use of a steam engine, or pumps.

Mr. Clift exhibited specimens of creosoted sleepers, which had been in use for ten years on the London and North Western Railway, near Manchester, and were still perfectly sound and unchanged; also specimens of creosoted piles from Lowestoft Harbor, which had been in the sea for four years, and continued quite fresh and sound, and without being touched by the worm; and specimens of similar piles uncreosoted, from the same situation, which were completely eaten away and honeycombed by the worm in the same period.

Mr. Bethell observed, that when he first began to preserve timber, he found that no pressure would get the creosote into it, owing to the presence of moisture in the pores; it therefore became necessary to adopt the system of drying the timber first; and, after fourteen days, he found that the wood lost three pounds in weight in every cubic foot: this was by the old process of drying. He then introduced the present drying house;

and, in twelve or fourteen hours, they lost eight pounds per cubic foot, in Scotch sleepers, which then absorbed an equal weight of creosote. An average of 11½ lbs. of creosote per cubic foot was now put into all the Memel timber at Leith harbor works; and it was forced in with a pressure of 180 lbs. per inch. One piece of creosoted timber had been observed at Lowestoft, which had been half cut through for a mortise, but not filled up again, and a teredo had penetrated a little way into it at that part, and then attempted to turn to the right, and then to the left, and had ultimately quitted the timber without proceeding any farther. Young wood was the most porous round the exterior, and consequently absorbed most creosote, which formed a shield to keep off the worm. The creosoted sleepers were better, after eight or ten years, than when new, because the creosote got consolidated in them, and rendered them harder. He had taken the idea originally from the Egyptian mummy; it was exactly the same process; any animal put into a creosote tank assumed the appearance and became in like condition to a mummy. Timber creosoted was now chiefly used in railways; but he believed that, if it was introduced into coal pits, it would be found that no timber so used in those places would rot.

The Chairman inquired whether, in the process of creosoting, the quantity of sap was calculated, and how the exact quantity of creosote that was put into the timber was ascertained.

Mr. Bethell replied, that every piece of timber was weighed before it was put into the creosote tank, and again when taken out; and each piece was required to be increased in weight, by the process, 10 lbs. per cubic foot. The quantity of oil used always rather exceeded the weight gained in the timber, on account of the loss of weight from the moisture extracted by the exhaustion of the air pump. He also remarked, in answer to another question from the Chairman, that oak only absorbed half as much creosote as Memel timber. Common fir creosoted would last double the time of hard wood creosoted, because it took more creosote. Beech made the best wood, being full of very minute pores; and they could force a greater quantity of creosote into beech than into any other wood; consequently it took a more uniform color throughout from the process. Long pieces of timber were found to require more time to saturate them in proportion to their length. The creosote appeared to enter at the two ends, and be forced up through the whole length of the pores; and the progress was known by the quantity of creosote forced into the tank after it was filled, according to the number of cubic feet of timber contained in the tank.

An Investigation of the Strains upon the Diagonals of Lattice-beams, with the resulting Formulæ. By W. T. Doyne, *Assoc. Inst. C. E., and* Prof. W. B. Blood.*

The experiments detailed in the paper were made on a model 12 feet in length, so constructed that the diagonals in compression (which were strips of mahogany, let into the top and bottom, but not fastened to them, and the ties, which were of hoop iron chains,) must of necessity take their

* From the London Journal of Arts and Sciences, December, 1851.

respective bearing and strain; and by the substitution of a dynamometer for any one of the ties, the strain on it could be accurately measured.

The results of the investigation (which were given in a table, showing a remarkable coincidence between the strains as measured and calculated) were, that for a parallel beam of one span, supported at each end and loaded at the centre, the strains throughout the diagonals were uniform, and the horizontal strains were greatest at the centre, decreasing uniformly at the points of support. For a similar beam, uniformly loaded over its entire length, the strains on the diagonals commenced at the centre, increasing uniformly to the points of support; while the horizontal strains decreased from the centre to the ends, in the ratio of the ordinates of a parabola. These results were arrived at by different methods of reasoning, and the formulæ derived from them were stated to be applicable to the more complex form of a closely intersected lattice, taking into consideration the increased number of triangulations.—*Proc. Inst. Civ. Eng.*

On the Discharge of Water over Weirs and Overfalls. By Thomas Evans Blackwell, *M. Inst. C. E.**

[Paper read at the Institution of Civil Engineers, May 6, 1851.]

The establishment of certain natural laws in hydraulics has occupied the attention of philosophers from the days of Galileo to the present time, and although the great principles which now form the groundwork of modern hydraulic science are indisputably settled, yet much remains to be done by practical men, towards applying the necessary corrections for special circumstances; this is only to be accomplished by a faithful record of facts, and in engineering there is perhaps scarcely a branch where there is a greater want of them than in that of hydrodynamics.

This deficiency was particularly felt by the author of this paper, in the case of weirs or overfalls, established, by order of Parliament, for regulating and measuring the flow of water into a canal; and, as frequent doubts and disputes had arisen, the following experiments were undertaken for determining, by absolute trials, the discharge that might be expected from such orifices; and, as the opportunities for making such experiments are not of frequent occurrence, the results were carefully recorded, in order to submit them in detail for the consideration of the Institution.

The first set consists of a series of 243 experiments, made on overfalls of 3 feet, 6 feet, and 10 feet in width, with heads from 1 inch to 14 inches, and with the varying circumstances of having, for the overfall bar,—1st, a thin plate; 2d, a plank 2 inches thick; and, 3d, a crest 3 feet in breadth. These were all made on the Kennet and Avon Canal, in July, 1850.

The second set was made in conjunction with Mr. Simpson (V. P. Inst. C. E.), who has kindly permitted the results to be placed on record. The series consists of about 70 experiments, made on an overfall of about 10 feet in width. These were made at Chew Magna, Somerset, also in the summer of 1850. Although in some respects, as being made over a

* From the London Architect for January, 1852.

bar 2 inches thick and 10 feet long, many of the experiments are apparently parallel in both cases, they must be separately considered, on account of some peculiar circumstances which will be stated. Before considering these experiments in detail, it may be well to review, briefly, some of those previously ma deby English and Continental observers, and the practical deductions which had been arrived at by the writers on this subject.

Fig. 1. Plan.—Scale, 40 feet to 1 inch.

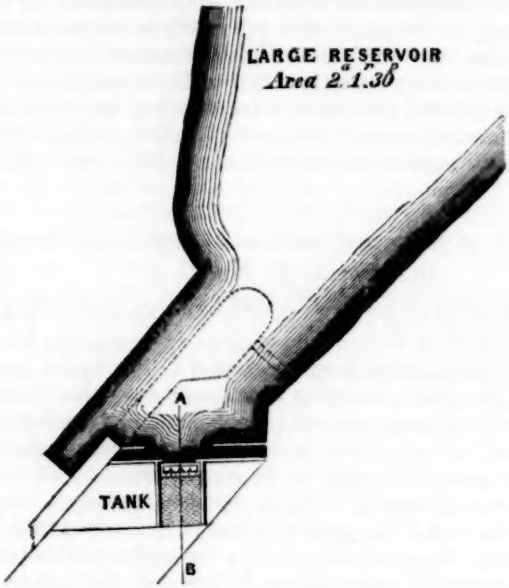
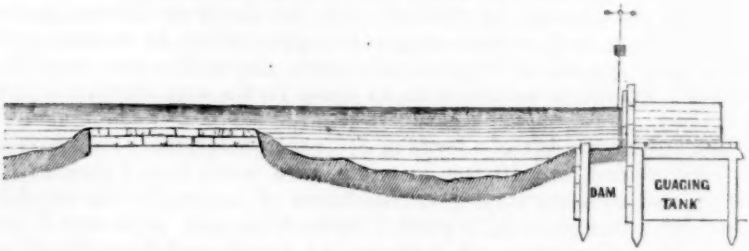


Fig. 2. Section on the line A B.—Scale, 8 feet to $\frac{3}{4}$ inch.



The most scientific series of experiments on the discharge of fluids through orifices have been made by foreign observers, and their labors must be familiar to hydraulic engineers; but the Chevalier Du Buat, Eytelwein, MM. D'Aubuisson and Castel, and MM. Poncelet and Lesbros, have made the principal observations on the passage of water over weirs.

Those of Du Buat, in 1779, were but few in number, and were on overfalls of $18\frac{3}{4}$ inches wide, and an extreme depth of $6\frac{1}{4}$ inches.

In 1827 and 1828, MM. Poncelet and Lesbros made a very elaborate series of experiments, on the discharge of water by rectangular orifices. They were conducted in the fortifications at Metz. Of these, only thirty-six related to overfalls, or 'deversoirs.' The head of water was varied from about $\frac{3}{4}$-inch up to 8 inches, and the width was constantly about $7\frac{3}{4}$ inches. They found that the coefficient for contraction was constantly varying, as the head was increased or diminished.

In 1834, MM. D'Aubuisson and Castel made a series of experiments, at the Toulouse water-works, with overfalls which discharged water from a rectangular canal $29\frac{3}{4}$ inches wide, and of variable depth. The widths of the apertures ranged upwards to the full width, and the head varied from about 1 inch to 8 inches.

Messrs. Smeaton and Brindley conducted a set of experiments, made over a waste-board of the width of 6 inches, and from 1 inch up to 6 inches deep. These, and the experiments of Dr. Robison, quoted in the *Encyclopædia Britannica*, appear to be the principal observations made and published in this country.

A comparison of the results of the foregoing experiments, and the coefficients applicable to them and to the present experiments, is given in the Appendix.

The Kennet and Avon Canal experiments were made on a reservoir, or side pond, measuring 2 acres, 1 rood, 30 poles, or 106,200 square feet in area, with a lock at each end, so that there was not any current. The weather was uniformly fine, and during six-sevenths of the time, the wind was very slight, blowing somewhat diagonally up stream, or against the course of the overfall; during one day the wind was more rough, blowing exactly down the stream; such of the experiments, made on that day, as are given in the tables, and are used in the calculations, are reduced to the standard of the others; a means of doing so being presented, by exactly parallel experiments, made on the more favorable days. It may not be uninteresting to know, that the coefficient of correction was found to be about 5 per cent.

The form of the overfall, and its relative size and position on the reservoir, will be understood by reference to figs. 1 and 2, and the object in presenting this memoir being to give an accurate record of facts, which may be of practical utility, it is necessary to point out two or three special circumstances, which may possibly, to some slight extent, have influenced the discharge, though the observations made during the progress of the experiments, would induce the belief that such influence was very small. The first is, that the water supplied from the reservoir above the one on which the experiments were made, did not feed exactly in the same proportion as it was taken out; it was let in by the upper lock, three or four times a day, or as often as was requisite. The area of the reservoir, however, was so large (106,200 square feet), that the difference of head between the beginning and the end of any one experiment, could scarcely be perceived. The second feature is, that at some little distance above the overfall, the depth of water was reduced, by a submerged course of masonry, belonging to the dock in which the trials were made,

and which rose to within 18 or 20 inches of the surface. The third feature is, that the overfall was placed on the outer line of the dam, so as to obtain the requisite fall, and was not exactly in the line of one of the sides of the reservoir. These are circumstances which could not have been conveniently altered, without considerably increasing the expense of the experiments, and as the approach to the overfall was at least 40 feet wide, it was thought that the general arrangements would fairly represent the case of discharge of water by an overfall from a large still reservoir.

Every care was taken to determine correctly the head of water acting in each experiment, and by such head is meant, throughout this paper, the total depth from the surface of the still water to the crest of the bar of the overfall. The bar forming the top of the overfall was made to rise or fall, and could be very accurately adjusted, by means of a hand-screw at each end; to this bar, which was about 12 feet in length and 2 feet deep, were fixed two gauge-rods, working in grooves, cut in a transverse beam above. The head having been determined on, the crest of the bar was brought exactly level with the still water in the reservoir; the line where the gauge-rods cut the top of the groove was marked with a pencil, and the required head was also measured and marked off on the gauge-rod. A man at each end then lowered the overfall bar down to the given head; the water was allowed to run through the waste trunk, till it had assumed an uniform regime, when, at a given signal, the lid covering the gauging tank was raised, and the time of filling the tank to a given height was accurately observed. The time was kept by two and sometimes by three assistants, and it was registered to quarter seconds. The particular mode of obtaining the head was in some degree a matter of necessity, arising from the desire to avoid the waste of water out of the canal, in the larger experiments.

The gauging tank had a floor of brick, laid in cement, with plank sides, and was carefully measured; its total capacity was 444·39 cubic feet; in the experiments with very small heads, it was only filled to a certain height; whatever leakage there was into the gauging tank, during some of the experiments, was measured in a separate vessel, and in the tables of experiments correction is made for this, in taking the quantity discharged during each experiment.

The thin plate, mentioned in some of the experiments as forming the overfall bar, was a piece of iron fender plate, barely $\frac{1}{16}$-inch thick; the plank, 2 inches thick, was square on the top, and the broad crest used was an apron formed of deal boards, roughly planed over, and fastened on to the outer edges of the plank, so as to form an uninterrupted continuation of it; the object in this case was to approximate towards a well constructed wide-crested weir, such as is found in rivers, &c.

The experiments tried in conjunction with Mr. Simpson, at Chew Magna, were made on a very small reservoir, which was kept constantly supplied by a pipe 2 feet in diameter, discharging from an upper reservoir, under a pressure of nearly 19 feet; the weather was generally fine, sometimes rather windy, but as the place was well sheltered by high walls, the effect of this was not much felt. In consequence of the distance between the discharge pipe and the overfall being comparatively short, (about 100 feet,) the water must have retained some part of the velocity

due to its discharge under so great a head; this was perceptible to the eye, in heads above 5 or 6 inches, but the peculiar form of the reservoir prevented the amount being accurately determined. The results, however, show that this influence must have been considerable, and that the effect of water approaching an overfall with an initial velocity is an element which should never be disregarded.

Fig 3. Plan.—Scale, 40 feet to 1 inch.

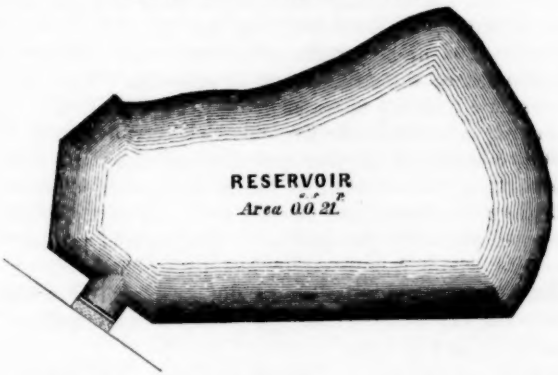
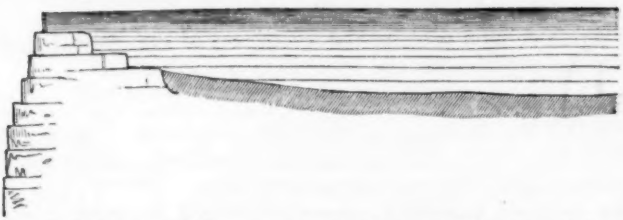


Fig. 4. Section through Overfall.—Scale, 8 feet to 1 inch.



The form of this overfall reservoir is shown in figs. 3 and 4. It had wings placed at an angle of 45°, well adapted for facilitating the discharge, and the overfall bar was a cast iron plate 2 inches thick, with a square top. The heads were measured on a bar 4 feet long, so placed diagonally in the still water that its zero was just level with the overfall top, and its upper end was raised 1 foot above. It was divided into twelve parts, which represented inches, and was again subdivided, so that each part was magnified four times, and one-sixteenth of an inch could be easily read. It was protected by a fender from the oscillations of the small waves in the reservoir. The time was kept by three and sometimes by four observers, who differed but little in their registers, of which a mean was taken. The gauging tank was a very good one, constructed for the purpose, of brick in cement, and built to hold 400 cubic feet; but by accurate admeasurement it was found to contain 389·79 cubic feet, and this quantity is used in the calculations. In this, as in the former set of experiments, efficient means, which it is not necessary to detail, were used for conveying the water from the overfall to the tank, for registering the leakage, &c.

Proceeding, then, to an explanation of the tables, it may be remarked, that the observations have been classified under the several descriptions, viz: over a plank 2 inches thick, with square edges; over a thin plate; over a crest, resembling the top of a weir, of which the breadth was 3 feet, the position of the surfaces horizontal, and also at inclinations, downwards, of 1 in 18, and 1 in 12 respectively. These main divisions were observed throughout, and the lengths of the weirs were severally 3 feet, 6 feet, and 10 feet. The first column in the table of experiments shows the head, or difference of level between the top of the overfall bar, or crest, and the level of the still water in the reservoir. The second column shows the duration of the experiment in seconds. The third column shows the absolute quantity of water discharged during the experiment, correction having been made for the leakage if any occurred. The fourth column is the reduction of the two preceding columns into cubic feet per second. The fifth is the reduction of the several results of similar experiments, with the same head and length, as shown in the former column, to an average of cubic feet per second. The sixth is a reduction of the discharge, so ascertained, into cubic feet per second, for each foot of width. The seventh column contains the coefficient of correction (m), deduced from the experiments and applicable to the formula—

$$Q = \sqrt{2gH} \times lH \times m \quad . \quad . \quad . \quad \text{(I.)}$$

in which Q is the discharge in cubic feet per second; $\sqrt{2g} = 8{\cdot}03$; H, the head in feet; l, the width of the overfall; and m, the coefficient of correction.

The eighth column contains the coefficient of correction (k), deduced also from the experiments and applicable to the formula*—

$$H^{\frac{3}{2}} \times l \times k. \quad . \quad . \quad . \quad . \quad . \quad \text{(II.)}$$

in which Q is the discharge in cubic feet per second; l, the width of the overfall in feet; H, the head in inches, or the height of the still water in the reservoir, above the crest of the overfall.

[Two columns, numbered respectively 9 and 10, were given in Mr. Blackwell's paper; but the particulars recorded not being taken in all the experiments, we have thought proper to omit them; the following may, however, be stated as the results arrived at in those which were observed]:—First, that the head of water, above an overfall, may be ascertained approximately, but only so, by the insertion of a 2-foot rule, held against the stream on the overfall bar, and observing the height to which the water rises, as the total head above the crest. Secondly, that the thickness of the blade of water, relatively to the total head, was much less than that which Du Buat assumed, in the theory on which his formula was based; which was, that this thickness was equal to half the total depth, from the crest to the top of the water. Indeed, it much more nearly agreed with the results which Professor Robison has recorded, and which he gives as about five-sevenths of the total depth. In the present experiments, it was found that, in the case of the plank overfall 2 inches wide, the thickness

*This formula is the same as that in general use among English engineers, viz: $D = H^{\frac{3}{2}} \times 5{\cdot}1$, in which D is the number of cubic feet discharged per minute for every foot in width of the overfall. H, the head in inches. 5·1 the *constant* coefficient of reduction. (The *variable* value of the coefficient (k) is, however, shown in these experiments.)

varied from six-tenths to eight-tenths, following the law of increase, as the total head increased. The exact ratios are inserted in the tables of experiments. In each of these cases, the admeasurement was taken at the outer edge of the bar, or at the lower end of the apron.

With a view of ascertaining how nearly the discharges of water follow the natural parabolic law, several curves were projected, in which the abscissæ represented the quantities discharged per second, under the various heads shown by the corresponding ordinates. From these it was seen, that though they evidently followed the fundamental law, yet the various opposing forces called into play, as the heads and widths increased or decreased, produced anomalies and variations from that curve, which entirely destroyed its regularity.

The whole of the coefficients given in the tables have been plotted, in such a manner as to show the mean coefficient for each set of experiments, and the variations for each change of head. This method shows in a striking manner, that no formula with a constant coefficient will give the true discharge of water by a weir. It is also interesting to observe, that whereas, in some instances, the coefficient is higher with a small head, and decreases as the head increases, in others the reverse takes place. Thus it will be seen, that where the overfall bar was a piece of thin plate, with a head of 1 inch, the coefficient was considerably higher than the mean; whilst a similar length of overfall, consisting of a plank 2 inches wide, gives the coefficient as much less than the mean; again, whilst the coefficient for an overfall formed of a plank 2 inches wide and 3 feet long, with a head of 1 inch, gives a coefficient of ·331, the same head and length of crest of 3 feet, gives only ·301 as a coefficient.

Experiments on Overfalls, Kennet and Avon Canal.

Overfall.	Total Depth of Water above Crest, in inches.	Time in seconds.	Cubic Feet Discharged.				Coefficients.	
			Total Quantity.	Per Second.	Average per Second.	Per second for 1 foot in width.	*m*	*k*
Table I.—A thin Plate, 3 ft. long.	1	176½	45·97	·260	·260	·087	·451	·087
	2	124½	91·94	·739	·739	·246	·450	·087
	3	72¾	91·94	1·264	1·264	·421	·420	·081
	4	96	182·94	1·906	1·906	·635	·411	·079
	5	99½	259·01	2·603	2·603	·868	·401	·078
	6	131¼	441·77	3·366	3·366	1·122	·395	·076
						Mean	·421	·080
Table II.—A thin Plate, 10 ft. long.	1	177¼	183·90	1·038	1·038	·104	·539	·104
	2	63	183·90	2·920	2·920	·292	·535	·102
	3	103¼	444·39	4·304				
	3	62	260·50	4·201	4·286	·429	·428	·082
	3	42½	183·90	4·352				
	4	65½	442·43	6·755	6·755	·675	·437	·089
	5	47¼	442·03	9·355	9·355	·935	·433	·083
	5	47¼	442·03	9·355				
	8	26	441·77	16·988	16·909	1·691	·387	·075
	8	26¼	441·77	16·830				
	9	24	441·99	18·416	18·416	1·842	·353	·069
						Mean	·445	·086

Experiments on Overfalls, Kennet and Avon Canal. (Continued.)

Overfall.	Total Depth of Water above Crest, in inches.	Time in seconds.	Cubic Feet Discharged.				Coefficients.	
			Total Quantity.	Per Second.	Average per Second.	Per second for 1 foot in width.	m	k
Table III.—Plank, 2 inches wide, 3 feet long.	1	757	137·91	·181	·180	·060	·311	·060
	1	280¾	45·97	·164				
	1	235	45·97	·195				
	2	167	91·94	·550	·555	·185	·339	·065
	2	164	91·94	·561				
	3	159	183·90	1·157	1·138	·376	·375	·072
	3	82½	91·94	1·114				
	3	80½	91·94	1·143				
	4	147½	259·00	1·756	1·695	·565	·366	·071
	4	158½	258·92	1·634				
	5	172½	442·67	2·566	2·537	·846	·392	·076
	5	176½	442·63	2·508				
	6	131½	443·07	3·370	3·363	1·121	·395	·076
	6	132	443·07	3·356				
	7	100½	442·38	4·402	4·413	1·471	·411	·074
	7	100	442·39	4·424				
	8	83½	442·30	5·297	5·297	1·766	·404	·078
	8	83½	442·30	5·297				
	9	70¾	442·62	6·256	6·256	2·085	·400	·077
	10	58¾	442·92	7·539	7·492	2·497	·409	·079
	10	59½	442·99	7·445				
						Mean	·380	·073
Table IV.—Plank, 2 inches thick, 6 feet long.	1 to 15/16	487½	171·23	·354	·354	·059	·306	·059
	2	137½	184·34	1·317	1·222	·204	·374	·072
	2	159	179·76	1·128				
	3	184½	439·60	2·383	2·396	·399	·398	·077
	3	183½	439·62	2·396				
	3	184	439·61	2·389				
	3	183½	439·62	2·396				
	3	181½	439·68	2·422				
	3	184	439·61	2·389				
	4	127	439·31	3·463	3·563	·594	·383	·074
	4	120	439·60	3·663				
	5	82½	442·24	5·359	5·209	·868	·401	·078
	5	86½	442·15	5·126				
	5	86	442·16	5·141				
	6	64½	442·72	6·890	6·890	1·150	·405	·074
	6	64½	442·72	6·890				
	7	49½	443·11	8·997	8·695	1·449	·405	·073
	7	51½	443·06	8·631				
	7	52	443·04	8·520				
	7	51½	443·06	3·631				
	8	43	443·27	10·309	10·309	1·718	·393	·076
	8	43	443·27	10·309				
	9	37½	443·41	11·850	11·850	1·975	·379	·073
	9	37½	443·41	11·850				
	9	37½	443·41	11·850				
	10	34¼	443·03	12·950	13·156	2·193	·359	·069
	10	33¾	443·07	13·363				
	12	26¾	443·32	16·515	16·356	2·726	·350	·066
	12	27¼	443·30	16·207				
	14	20¼	443·58	21·890	22·183	3·697	·366	·071
	14	19¾	443·60	22·477				
						Mean	·377	·072

Experiments on Overfalls, Kennet and Avon Canal. (Continued.)

Overfall.	Total Depth of Water above Crest, in inches.	Time in seconds.	Cubic Feet Discharged.				Coefficients.	
			Total Quantity.	Per Second.	Average per second.	Per second for 1 foot in width.	m	k
Table V.—Plank, 2 inches thick, 10 feet long.	1	230	152·62	·665	·563	·056	·290	·056
	1	454¾	207·30	·461				
	2	81½	172·82	2·125	2·129	·213	·390	·075
	2	81	172·89	2·134				
	3	47	177·51	3·777	3·803	·380	·379	·073
	3	46	177·65	3·862				
	3	48	177·38	3·695				
	3	111¼	431·38	3·877				
	4	67¼	436·53	6·491	6·192	·619	·401	·077
	4	67½	436·50	6·468				
	4	72¾	440·76	6·059				
	4	73½	440·72	5·996				
	4	73	440·74	6·038				
	4	73¼	440·73	6·098				
	5	48¾	438·69	8·998	8·774	·887	·406	·078
	5	50¼	438·52	8·726				
	5	51	438·43	8·597				
	6	41¾	438·72	10·512	10·881	1·088	·384	·074
	6	40	438·95	10·976				
	6	40	438·95	10·976				
	6	39¾	439·74	11·063	11·063	1·106	·384	
	7	32¼	440·01	13·780	13·720	1·372	·384	·074
	7	33¼	439·80	13·164				
	7	32	440·04	13·887				
	7	32	440·65	13·885				
	7	32	440·65	13·885				
	8	28¾	440·48	15·474	15·943	1·594	·365	·071
	8	27	440·12	16·463				
	8	28	440·59	15·993				
	9	22½	441·33	19·613	19·417	1·942	·372	·072
	9	23¼	441·16	18·575				
	9	22	441·40	20·063				
	10	20	441·67	22·083	21·737	2·174	·356	·069
	10	21	441·54	21·026				
	10	20	442·05	22·102				
	12	15½	442·29	28·529	28·529	2·853	·356	·069
						Mean	·371	·072
VI. Plank, 2 in. wide, 10 ft. long.*	5	45¾	442·11	9·664		0·966	·447	·086
	4	65½	441·77	6·745		0·674	·437	·088
	2	106	260·50	2·460		0·246	·450	·087
	1	190	183·90	0·969		0·097	·503	·097
						Mean	·459	·090
VII. Crest, 3 ft. wide, 3 ft. long, slope 1 in 12	1	254½	45·97	·181	·181	·060	·311	·300
	2	236¾	137·91	·582	·582	·194	·355	·069
	3	170¼	183·90	1·080	1·080	·360	·359	·069
	4	188½	257·75	1·404	1·404	·468	·303	·0585
	6	146½	441·46	3·014	3·014	1·005	·354	·068
	7	117½	442·04	3·762	3·762	1·254	·351	·068
	9	85¼	442·26	5·188	5·188	1·729	·332	·064
						Mean	·338	·065

* With wing-boards converging at an angle of 64°.

Experiments on Overfalls, Kennet and Avon Canal. (Continued.)

Overfall.	Total Depth of Water above Crest, in inches.	Time in seconds.	Cubic Feet Discharged.				Coefficients.	
			Total Quantity.	Per Second.	Average per second.	Per second for 1 foot in width.	m	k
VIII. Crest, 3 ft. wide, 3 ft. long, sloping 1 in 18.	1	218¾	45·97	·210	·210	·070	·363	·070
	2	230¾	137·91	·597	·597	·199	·364	·070
	3	170¾	183·90	1·077	1·077	·359	·358	·069
	4	194	257·58	1·328	1·328	·443	·287	·055
	5	197½	440·44	2·230	2·230	·743	·344	·066
	7	120½	441·98	3·667	3·667	1·222	·342	·066
	8	103¼	441·81	4·279	4·279	1·426	·327	·063
	9	86½	442·23	5·112	5·127	1·709	·328	·063
	9	86	442·24	5·143				
						Mean	·339	·065
IX. Crest, 10 ft. long, 3 ft. wide, sloping 1 in 18.	1 to ⅞	282	169·80	·603	·603	·060	·311	·060
	2	138¼	253·59	1·834	1·805	·181	·330	·064
	2	100½	178·88	1·777				
	4	83	440·24	5·304	5·304	·530	·343	·066
	6	43	442·24	10·285	10·285	1·028	·362	·070
	8	30	442·89	14·761	14·761	1·476	·338	·066
						Mean	·337	·065
X. Crest, 3 ft. wide, level, and 3 feet long.	1	265½	45·97	·173	·173	·058	·301	·058
	2	350	183·90	·525	·525	·175	·321	·062
	3	294	260·50	·886	·886	·295	·294	·057
	4	200	258·50	1·292	1·292	·431	·279	·054
	5	213½	441·19	2·066	2·066	·689	·319	·061
	6	158	441·23	2·892	2·840	·947	·334	·064
	6	65½	182·59	2·788				
	7	126¾	441·86	3·486	3·486	1·162	·325	·060
	7⅞, 8	108	441·69	4·089				
	8	107½	441·71	4·109	4·109	1·369	·313	·061
	9	89¾	442·15	4·926	4·926	1·642	·317	·061
						Mean	·311	·060
XI. Crest, 3 ft. wide, level, and 6 ft. long.	1 to 1¼	405	173·37	·429	·429	·071		
	3	222¼	438·52	1·973	1·971	·329	·328	·063
	3	223¾	438·58	1·961				
	3	221¾	438·63	1·978				
	4	142	438·72	3·019	3·068	·511	·331	·064
	4	144	438·64	3·045				
	6	77½	442·38	5·781	5·781	·963	·008	
	7	61¾	441·61	7·150	7·150	1·191	·331	·060
	9	44½	443·24	9·964	10·019	1·670		
	9	44	443·25	10·074				
	0	39	442·84	11·360	11·360	1·895	·310	·060
	0	39	442·84	11·360				
	2	29¾	443·21	14·900	14·965	2·495	·311	·060
	2	29½	443·21	15·030				
						Mean	·322	·061
XII. Crest, 3 ft. wide, level, and 10 ft. long.	1	339½	166·93	·092	·492	·049	·254	·049
	2	101½	178·83	1·762	1·736	·174	·319	·061
	2	104½	178·68	1·710				
	5	59¼	441·43	7·450	7·450	·745	·345	·066
	6	45½	442·12	9·717	9·717	·972	·342	·066
	8	32½	442·77	13·622	13·622	1·362	·312	·060
	9	26¼	443·08	16·879	16·879	1·688	·324	·063
	10	24	443·19	18·467	18·467	1·847	·303	·059
						Mean	·314	·061

Table XIII.—Experiments on Overfalls, Chew Magna.

Overfall Bar, 2 inches wide, 10 feet long.

Total Depth of Water above Crest, in inches.	Time in seconds.	Cubic Feet Discharged.				Coefficients.	
		Total Quantity.	Per Second.	Average per second.	Per second for 1 foot in width.	m	k
1 to $\frac{7}{8}$	560½	384·71	·690	·690	·069	·394	
1 to $1\frac{1}{16}$ b	469	384·71	·820				
$1\frac{1}{16}$ bare	439	384·71	·870	·860	·086	·417	
$1\frac{1}{16}$ good	434½	384·71	·880				
$2\frac{3}{16}$	139¼	398·79	2·900	2·900	·290	·455	
$2\frac{1}{4}$	133¾	385·79	2·900				
$2\frac{9}{32}$ good	98¼	383·71	3·906	3·906	·391	·443	
$2\frac{5}{32}$	98	383·71	3·916				
$2\frac{5}{32}$	97½	383·71	3·916				
$2\frac{5}{32}$	97¼	383·71	3·950	4·016	·402	·447	
$2\frac{5}{32}$	97⅛	383·71	4·104				
$2\frac{5}{32}$	97⅛	383·71	4·104				
$2\frac{5}{32}$	97⅛	383·71	4·104				
$2\frac{7}{32}$	93¼	383·71	4·115	4·115	·412	·437	
$2\frac{9}{32}$	92½	383·71	4·148	4·148	·415	·435	
$2\frac{5}{16}$	94¼	398·79	4·231	4·231	·423	·436	
3 bare	82	385·71	4·700	4·700	·470	·469	
3 to $3\frac{1}{16}$	80	385·71	4·820	4·820	·482	·483	
4 bare	52½	385·71	7·340	7·340	·734		
4	50	385·71	7·710				
4	50	385·71	7·710	7·680	·768	·497	
4	50½	384·71	7·620				
$4\frac{1}{16}$	46	383·71	8·342				
$4\frac{1}{16}$	46	383·71	8·342	8·358	·836	·495	
$4\frac{1}{16}$	45¾	383·71	8·390				
$4\frac{5}{16}$	45	383·71	8·530				
$4\frac{5}{16}$	44¼	387·75	8·770				
$4\frac{5}{16}$	43½	386·71	8·890	8·770	·877	·507	
$4\frac{5}{16}$	43½	386·71	8·890				
$4\frac{3}{8}$	44	383·71	8·721	8·721	·872	·494	
$4\frac{7}{16}$	41¾	383·71	9·190				
$4\frac{7}{16}$	42¼	383·71	9·090	9·017	·902	·500	
$4\frac{7}{16}$	43½	385·71	8·870				
$4\frac{7}{16}$	43½	385·71	8·920				
$4\frac{1}{2}$ bare	43¾	385·71	8·820				
$4\frac{7}{16}$ bare	43½	385·71	8·870	8·887	·889	·483	
$4\frac{1}{2}$ bare	43	385·71	8·970				
5 bare	34	383·71	11·290	11·290	1·129	·520	
$5\frac{5}{16}$	33½	383·71	11·460	11·460	1·146	·521	
$5\frac{13}{32}$	31¾	383·71	12·086	12·086	1·209	·499	
$5\frac{7}{16}$ to $5\frac{15}{32}$	31	383·71	12·380	12·380	1·238	·501	
	31	383·71	12·380				
$5\frac{15}{16}$	28¼	385·71	13·530	13·530	1·353	·485	

TABLE XIII.—EXPERIMENTS ON OVERFALLS, CHEW MAGNA. (Continued.)

Total Depth of Water above Crest, in inches.	Time in seconds.	Cubic Feet Discharged.				Coefficients.	
		Total Quantity.	Per Second.	Average per second.	Per second for 1 foot in width.	m	k
6	27¼	385·71	14·150	14·150	1·415	·499	
6	27½	385·71	14·150				
6 3/16	28½	399·79	14·030	14·030	1·403		
6 3/16	27¾	398·79	14·370	14·03 0	1·443	·499	
6 3/16	27½	398·79	14·500				
6 3/16 to 6¼	26⅝	399·79	14·900	14·900	1·490	·498	
6 15/16	21¼	385·71	18·150	18·150	1·815	·515	
6 15/16	21¼	385·71	18·150				
7 21/32	20⅛	398·79	19·450	19·610	1·961	·478	
7 21/32	20¼	398·79	19·690				
7 21/32	20¼	399·30	19·690				
8	16½	385·71	23·380	23·380	2·338	·535	
8	16½	385·71	23·380				
8 to 8 13/16	15⅝	384·71	24·820	24·820	2·482	·491	
8 15/16	15½	384·71	24·820	24·820	2·482	·500	
9	14	385·71	27·550	27·550	2·755	·521	
9							
9		383·71	27·550				
					Mean	·480	

The first twelve tables give the results of the experiments made on the Kennet and Avon Canal, where the reservoir was large, in proportion to the overfall, and the water was still.

Table XIII. contains the results of the experiments made at Chew Magna, in Somersetshire, in which the reservoir was very small, in proportion to the overfall, and it was kept continually supplied by a pipe 2 feet in diameter, leading from a reservoir 19 feet above it. The columns, in this case also, have the same signification as those relating to the experiments on the Kennet and Avon Canal.

(To be Continued.)

For the Journal of the Franklin Institute.

Notice of a Railroad upon an Ice Grade. By ELLWOOD MORRIS, *Civil Engineer.*

The railroad lately laid upon a graduation of ice, provided by nature across the mouth of the Susquehanna river, at Havre de Grace, in the State of Maryland, seems to deserve a more permanent record than the fleeting notices of the daily press.

It adds another to the many striking evidences recently afforded, of the promptitude with which the mind of the American engineer and mechanic grapples with unexpected difficulties, and triumphs over them.

The railroad uniting the cities of Baltimore and Philadelphia, touches both banks of the Susquehanna river at its mouth.

The river here is about four-fifths of a mile in width, and forming a break in the railroad of that length, over deep water; the communication is usually kept up by means of a large steam ferry boat, upon which the passengers cross from one bank to the other, independent trains with their locomotives being in waiting upon both banks.

The passengers themselves debark, when they reach the river, and gain the boat through covered buildings, which screen them from the weather; their baggage, with the car containing it, is run upon the upper deck, and being carried over is replaced upon the railway on the further bank, and coupled to the train in waiting there.

Now the river Susquehanna, leading to the north, in bleak and mountainous regions, brings down in the winter season, great quantities of floating ice, which seriously impede the railroad ferry.

At the mouth of the river there is shoal water, in which the ice grounds, and in severe weather, it forms a point of support for successive floating masses, until it sometimes gorges up for many miles above the ferry of the railway line.

In forming these "*gorges*" of ice, the cakes edge up, and freezing together in that position, form a mass of great solidity and strength, but very rough upon the surface.

While this gorge is forming, the railroad ferry is necessarily discontinued, and when it has formed, the question arises—how is the business of the railway to be resumed?

These preliminary remarks bring us now to our main subject: In a severe winter like that of 1851-2, the engineer of the railway sees his ferry line at Havre de Grace cut off, and the river filled almost to the bottom with a vast accumulation of cakes of ice, a foot thick, edged up, and frozen in that position, so as to present a mass of great strength, but most forbidding superficial aspect.

Contemplating this with the true eye of science, and seeing its adaptation to his purpose, Mr. Trimble, the engineer of the railroad company, determined to form over this rude glacier, *a railroad* for his baggage and freight cars, and *a sledge road* along side of it, upon which two horse sleighs could carry his passengers, and by means of towing lines, propel the freight cars over the river. This was the great idea, and most promptly and successfully has it been carried out.

The first step was to *locate* the railroad; for upon this rough surface of ice, a straight line between the ferry landings, would have required too much graduation; too much excavation and embankment, (so to speak,) of ice and snow.

The line was accordingly staked out with several curves, so as to reduce the labor required in grading the frozen surface; the projections, points, and ridges were cut away, and broken fragments of ice were used to fill up the hollows. Then upon condemned ties, about four feet apart, with some new timber interspersed, a track was laid with U rails, of about 40 lbs. to the yard, confined merely by hook-headed spikes, and without chairs.

The surface of the ice being some 10 or 15 feet below the permanent

rails upon the two banks, was gained by temporary inclines, running off from the shores upon a rough blocking of cob work, so arranged as to be adjustable, and taking advantage of a low pier on the left bank, to reduce the grade. These inclines, and the track across the ice, were connected with the main line on both banks, by suitable switches, and formed in fact a species of sideling nearly a mile long. Upon the inclines the baggage and freight cars were worked one way by *gravity*, and the other by *roping*, from the locomotive train. Forty freight cars per day, laden with valuable merchandise, have been worked over this novel track by the means above referred to, and were propelled across the ice portion by two horse sleds running upon the *sledge road*, and drawing the cars by a lateral towing line, of the size of a man's finger.

At the present writing, this novel and effectual means of maintaining the communication at Havre de Grace, is still in successful operation, and will so continue until the ice in the river is about to break up. Then by means of the sledges, the rails, (the only valuable part of the track,) can be rapidly moved off by horse power, not probably requiring more than a few hours time, so that the communication may be maintained successfully until the last moment. If properly timed, (as it doubtless will be,) the railroad may be removed, the ice may run out, and the ferry be resumed, it may be, in less than 48 hours.

We cannot conclude this brief notice by an eye witness, without expressing our admiration of the ingenious practical arrangement, adopted for overcoming an extraordinary difficulty at this point, by Isaac R. Trimble, Esq., the engineer of the railroad company.

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*The Submarine Telegraph.**

At about half past 10 o'clock on Thursday morning the last portion of the wire leading from the Foreland was brought close under the walls of the Castle at the summit of the cliff, and thence gently dropped into the garden attached to the temporary office of the Company. The wire was then led into one of the upper rooms and connected with the telegraphic instruments. In addition to the well known apparatus of Messrs. Cooke and Wheatstone, the more modern inventions of Messrs. Brett and Henley had been enlisted for the occasion. After some little delay, consequent on the rapidity with which the arrangements were made, the wires were finally connected, and it became a moment of intense anxiety when signals were about to be passed. The instrument of Messrs. Cooke and Wheatstone was set in motion, signals were interchanged with Calais, and the complete success of the undertaking was completely evinced. But very few communications had passed when a mounted messenger arrived with a despatch from the telegraph office of the South Eastern Railway Company. It proved to be a communication containing the prices of the funds on the London Exchange, which were to be immediately sent on by the submarine telegraph to Paris. The particulars of the message were of course kept secret, but it was gratifying to observe that it was duly forwarded. From this time despatches were continually passing between the Dover telegraph offices and London and Paris. A message from

*From Herapath's Railway and Com. Journal, No. 649, November 15, 1851.

London was sent to Paris and an answer received from Paris and forwarded to London within one hour, and this time, it must be remembered, includes the distance of a mile traversed twice between the Dover offices, bringing the London message to the office of the Submarine Company and transmitting the reply to the office of the South Eastern Railway. To this must be added the loss of time consequent on the message having to be sent from the Paris office to the Paris Bourse, and the time taken for the reply from the Bourse to the Paris office.

AMERICAN PATENTS.

List of American Patents which issued from January 13, *to February* 3, 1852, (*inclusive,*) *with Exemplifications by* CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

25. For an *Improvement in Machines for Scouring Knives and Forks;* Christopher Aumock, Columbia, Ohio, January 13.

Claim.—"I claim the construction of this machine, composed of two cylinder brushes, with their peripheries in contact, which causes the friction necessary for scouring or polishing, and at the same time keeps the cylinder brushes, which do the work of polishing or scouring, wet with the polishing substance continually, while the machine is in motion, by immersing the under side of said brushes in the liquid as they revolve around on their axis, as above mentioned. The article to be scoured or polished must be held in a perpendicular position, and moved up and down between the cylinder brushes while in the act of scouring or polishing."

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26. For a *Blind and Shutter Operator;* James R. Creighton, Cincinnati, Ohio, January 13.

Claim.—"Having thus fully, clearly, and exactly described the nature, construction, and operation of my improvement in window blind openers and fasteners, what I claim therein as new is, the sliding extension rod, provided with the bent arm or hook, groove, notch, and tooth, as described, in combination with the staple, catch, and serrated neck, fitting into a corresponding socket in the plate; whereby the shutter or blind is opened or closed by manipulation from the inside, and retained in position when opened, by the fallen bent arm in the staple, and when closed, by the introduction of the bent arm into the notch in the catch, the serrated neck, with its corresponding socket in the plate, preventing the bent arm from being dislodged from either position, by tampering from the outside."

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27. For an *Improvement in Running Gear of Carriages;* Gustavus L. Haussknecht, New Haven, Connecticut, January 13.

Claim.—"I do not claim the separate use of one segment, on which the end of the perch rests; neither do I claim two pivots attached to the body: but what I do claim as my invention is, the placing the pivot in the rear of the forward axle, in combination with the two sets of segments or circles, viz: segments A, and segments D, seen at fig. 3, or their equivalents, substantially as above described."

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28. For an *Improvement in Apparatus for Cutting the Pile of Piled Fabrics;* John Johnson, Assignor to Elias Johnson, Troy, New York, January 13.

Claim.—"What I claim as my invention is, the method of connecting the cutter (one or more) with the carrier by means of a joint, substantially as specified, in combination with the guide or feeler (one or more), substantially as specified, whereby the guide or feeler is carried down, to determine the position of the cutter or cutters, before it or they begin to cut, as described.

"I also claim connecting the cutter or cutters and the feeler or feelers with the reciprocating carriage, by means of a spring joint, substantially as specified, so that the tension

of the spring, or its equivalent, shall draw the feeler or feelers against the range of loops to be cut, to insure the proper position of the cutter or cutters relatively to the range of loops to be cut, as specified.

"And finally, I claim the method of operating the cutters and guides or feelers towards and from the face of the cloth, and towards and from the lay, by connecting the ways on which the carriage runs, by arms, to the arms of a rock shaft, and to two inclined rocking joints, substantially as specified, whether the rock shaft be operated by the means specified or the equivalents thereof."

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29. For an *Improvement in Lanterns;* Philos Blake, New Haven, Connecticut, January 13.

"My improvement consists in attaching to the bottom of a lantern of any known or suitable construction, an additional appendage, whereby the lantern is made to rest securely and in an upright position on the top of the fore-arm of the person who carries it; thereby having both hands at liberty to perform manipulations, and at the same time presenting the light in the proper position for that purpose."

Claim.—"What I claim as my invention is, the combination of a lantern of any construction, with the additional appendage herein described and set forth, for the purpose of adapting the same to be carried on the top of the fore-arm, and of keeping it in an upright position. And this I claim, whether said appendage be constructed in the particular form and manner set forth, or in any other manner whereby the same object is accomplished, by substantially the same means."

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30. For an *Improvement in Ornamental Painting on Glass, &c.;* John W. Bowers, Brookline, Massachusetts, January 13.

"My process imparts to a painting on glass, an appearance very much like those figures which are executed on wood or papier mache, and which are more or less, or in part, made up of pieces of mother of pearl let into the wood. The paintings or figures produced by my said method have very beautiful properties of reflecting light, such as are often exhibited by silvered prismatic or crystaline surfaces."

Claim.—"What I claim as my improvement in ornamenting surfaces, consists in combining with the process of painting and ornamenting, by metallic foil, that of corrugating or crimping the foil, so as to impart to the figure or figures a power of reflecting light, so as to produce the sparkling, scintillated appearance, as specified."

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31. For an *Improvement in Machines for Dressing Stone;* Albert Eames, Springfield, Massachusetts, Assignor to Charles T. Shelton, City of New York, January 13.

"My invention relates to improvements on the machine for dressing stone, secured by letters patent granted to Charles Wilson, bearing date the 13th day of March, 1847, and re-issued 4th March, 1851."

Claim.—"What I claim as my invention is, making the upper surface of the ways elastic, substantially as described, in combination with the cutter carriage, constructed and operating in manner substantially as specified and for the purpose described.

"I also claim the manner, substantially as described, of mounting the stone carriage on wheeled axles, so that it can be elevated and depressed, in combination with the feeding platform, running on ways, substantially as described, so that the carriage can be run on wheels, to bring stones to and remove them from the machine, and be let down on to the platform, to receive the feed motion, as described.

"And, finally, I claim the dogs jointed to and in combination with the jointed arms, substantially as described, so that by means of wedges, or their equivalents, the block of stone can be adjusted and secured in place, as described."

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32. For an *Improvement in the Shakers of Winnowing Machines;* Henry Filburn, Dayton, Ohio, January 13.

Claim.—"What I claim as my invention is, the method of moving the shaker fingers, in the manner and for the purposes herein set forth."

33. For an *Improved Ornamental Connexion of the parts of an Iron Fence;* Henry Jenkins, Cincinnati, Ohio, January 13.

Claim.—"Having thus fully described my improvements in manufacturing fences, what I claim therein as new is, connecting the parts of a wrought iron fence to each other, by casting iron ornaments upon them, for the purposes of ornamenting and fastening the parts together, substantially in the manner herein described."

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34. For *Improvements in Beveling Planes;* Harrison W. Lewis, Bath, New York, January 13.

"This invention consists of a plane, or planing instrument, of peculiar form and furnished with several peculiar devices, so as to be adapted to the purpose of forming at one operation, and with extraordinary accuracy, a double bevel upon the grooved edge of a stile or rail of a panel door."

Claim.—"What I claim as my invention are, 1st, the adjustable gauge bar and the vertical adjustable guide, in combination with the double faced plane stock, all constructed and relatively arranged as herein described.

"2d, The combination of the guard screws, guard stock, adjustable guard, gauge bar, vertical guide, and plane stock; the whole being constructed and arranged, substantially in the manner and for the purpose herein set forth."

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35. For an *Improvement in Looms for Weaving Piled Fabrics;* Charles A. Maxfield, Troy, New York, January 13.

Claim.—"Having thus described my invention and improvement in the loom for weaving pile fabrics, I wish it to be understood, that it is not my intention to claim the use of the figuring or pile wires, upon which the loops or pile is raised; but what I do claim to have invented is, 1st, the employment on each side of the loom, of a wing, constructed substantially as described, when mounted upon either end of the lay, rock shaft, moving independent thereof, and of each other, and vibrating alternately with each other, in the arc of a circle scribed from the said rock shaft, and upon each are mounted the ways of the pile or figuring wires, whereby the said wires are carried rearward, to be re-inserted into the open shed, and thence forward to the last pick of the woof, or weft, as described.

"2d, I also claim causing the wings to recede, to carry the wires to the open shed, and then advance frontward with the wires to the woven pile, alternately, by the action of the lay itself, each wing being locked to the lay at the proper moment, and disengaged therefrom on the insertion of the wire, by the action of the curved lever as described.

"3d, I likewise claim pivoting the ways of each wing, and furnishing the inner ends thereof with arms projecting into openings in the breast beam, whereby the ways, with the figuring wires, are made to maintain a horizontal position, during the vibration of the wings, in the arc of a circle, as described.

"4th, I also claim providing each wing with a holding lever, pivoted to the frame and vibrating with the motion of the wing, and locked by means of a spring plate and pivoted arm, actuated by the advance motion of the double arms of the rock shaft, when the wire is at rest in the warp, whereby the wing is retained steadily in its position, until the withdrawal of the figuring wire.

"5th, I also claim combining the intermediate sliding arm, horizontal rods, with the carrier and wire, whereby the middle of the latter is sustained and prevented from trembling, whilst being inserted and withdrawn from the web, as described."

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36. For an *Improvement in Machines for Making Sugar Candy;* Bartholomew O'Brien, Rochester, New York, January 13.

Claim.—"What I claim as my invention is, making candy by machinery substantially as set forth."

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37. For an *Improvement in the Apparatus for Attaching pieces of Metal to each other, by Casting;* Horatio B. Osgood, Thompsonville, Connecticut, January 13.

"My improvement consists in making the jaws movable, so that they may be adjusted

to their proper positions, or changed for different shaped steel, when required, and so as to allow the levers to shrink, without any risk of straining the castings."

Claim.—"What I claim as my invention is, the use of movable jaws attached to the permanent parts of the flask, for the purpose of holding the steel pivots, or bearings, of levers and beams of platform scales and other analogous articles, firmly in the exact position required for use, while the fused iron or other metal is being poured into the mould, so as to fix them securely in the lever, &c., and so that the movable jaws will readily yield to the shrinkage of the metal while cooling, and prevent any injury from straining any of the parts, when the whole is constructed, arranged, and fitted to operate, substantially as herein described."

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38. For an *Improvement in Buckwheat Fans;* Alfred Platt, Waterbury, Connecticut, January 13.

Claim.—"What I claim as my invention is, the method of separating the hulls from the kernels of buckwheat, by shaking them on a table, or tables, made slightly concave and rough, substantially as specified, in combination with a current or currents of air blown over the surface of such table or tables, to carry off the hulls, whilst the kernels are retained or held back by the form of the surface of the table or tables, as specified."

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39. For an *Improvement in Machinery for Punching Sheets of Metal;* Samuel Lanford, Fall River, Massachusetts, January 13.

Claim.—"What I claim as my improvement is, the combination of the hinged flaps, M M, and their levers N N, restoring springs and tripping studs, or equivalent mechanic contrivances, with the movable carriage and the punching cylinders or mechanism; the whole being arranged and made to operate substantially as herein before specified."

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40 For *Improvements in Apparatus for Moulding in Flasks;* Edward Satterlee, Albany, New York, January 13.

Claim.—"Having thus fully described the parts and combination of parts, and operation of the moulding machine, what is claimed therein as my invention is, the making of moulds, in and by the alternate motions of a sifter, sliding knife to cut off the sand when the flask is filled, press, and movable bed, connected with and worked by the continuous motion of a single shaft, substantially as described in this specification."

"I do not cliam the sifter or press as my invention.

"I also claim as my invention, the moving, stopping, and starting of the bed, to and from the points, where the operation of sifting, filling, and pressing the sand are done, by the continuous rotary motion of a single shaft, substantially as described in the specification.

"I also claim the method of striking the surplus sand from the top of the flask after the curb is removed, by means of a self adjusting bar or knife, substantially as described and set forth in this specification."

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41. For an *Improvement in Metallic Heddles;* Jacob Senneff, Philadelphia, Pennsylvania, January 13.

Claim.—"What I claim as my invention is, casting the eye on the wire which constitutes the heddle, harness, or heald, through which the warp passes, in the manner and for the purpose set forth, producing a heddle much superior to any other known or used, and which will remove many of the difficulties heretofore experienced, in the use of the common twisted wire heddle."

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42. For an *Improvement in Turning Prisms, &c.;* Allen Sherwood and Avery Babbett, Auburn, New York, January 13.

Claim.—"What we claim as our invention is, the prismatic lathe herein described, consisting, essentially, of a rotating cutting instrument, whose cutters, in rotating, combine to describe a figure whose longitudinal sections are the counterparts of the outline of the longitudinal sections of the figure to be produced, and of a carriage to hold the block in

such a position, that its axis is always parallel with that of the cutting instrument, and at the same time, to move it transversely to the same, for the purpose described, and allow it to be turned on its axis at pleasure, and to be held from turning, while being acted upon by the cutters."

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43. For *Improvements in Machines for Splitting Rattan;* Joseph Sawyer, Royalston, Massachusetts, January 20.

Claim.—"Having thus fully described my invention, what I claim as new is, the employment, in combination with the cutters for splitting off the strands, of feed rollers or their equivalents, having grooves of the form of an angle or certain of the sides of a polygon, of which the edge or edges of the knife or knives form another side or other sides, substantially as and for the purposes herein described."

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44. For an *Improved Process of Mashing Maize;* Frederick Seitz, Easton, Pennsylvania, January 20.

Claim.—"Now what I claim as my invention and improvement in the brewing and distilling business is, the above specified preparation and boiling of the corn for brewing and distilling, boiling it to a jelly before the malt or rye is mashed into it, giving a much larger than the usual yield from cheaper material, enabling me to use one-half to two-thirds corn for beer, ale, and porter, and to make 19 quarts of whiskey from 60 pounds of corn, (including the usual quantity of malt only, and no rye,) and 21 quarts, with rye, as specified."

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45. For *Improvements in Planing Machines;* G. W. Tolhurst, Cleveland, Ohio, January 20.

Claim.—"Having thus fully described my invention, I would state, I am aware that the stocks and cutters of planing machines have been made to yield upon an axle, the centre of which is in line with the cutting edge of the knife. This I do not claim; but what I do claim is, hanging the stock at a line above the edge of the cutter, to a spring or weighted lever, in the manner described, in combination with the resting of the front part of the stock upon a fixed surface, so that when the back part of the stock is made to rise, the whole stock is thrown forward and upward, thus keeping the edge of the cutter at the same level, notwithstanding the change in its angle with the bed."

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46. For an *Improvement in Grain Harvesters;* Thomas Van Fossen, Lancaster, Ohio, January 20.

Claim.—"Having thus fully described my invention, what I claim therein as new is, constructing the reel with hinged or jointed slats, having teeth projecting from them, whereby the grain is more effectually collected, raised, and drawn into the action of the cutters, substantially as described.

"I also claim the combination of the teeth with the sliding platform, which teeth rise and fall at the desired time, alternately, arresting and releasing the cut grain, whereby the reciprocating motion of the platform will keep the cut grain strait, and constantly moving on the platform towards the trough, substantially as described."

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47. For an *Improvement in Canal Locks;* W. W. Virden, Havre de Grace, Maryland, January 20.

"The nature of my invention refers to the economizing of water, in passing canal or other boats from one level to another, and consists in the use of plungers or floats working in suitable chambers, provided with appropriate passages and wickets connecting them with the lower level, to which plungers the boat in its passage through the lock is attached, so that in falling to the lower level, the weight of the boat is made to force up the water in the float chambers to the higher level, thus contributing to the latter level an amount of water to sustain the loss by the quantity passing off the lower level."

Claim.—"What I claim as my invention is, causing the weight of the descending boat to act as a supplying power to the higher level, by the use of plungers or floats, (any number,) fitting in suitable chambers, provided with appropriate passages, and communicating

with the higher and lower levels for operation, in the manner essentially shown and described."

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48. For an *Improvement in Spring Mattresses;* John Waters, Southwark, Pennsylvania, January 20.

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, the method herein described of securing the springs of spring mattresses to the frame and to each other, so as to leave the tops of the springs free to play or yield to any pressure, viz: by connecting them together by a riveted leather hinge, and allowing the longitudinal and cross pieces of the frame to pass through a slot in said leather hinges, the whole being combined and arranged in the manner and for the purpose set forth."

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49. For an *Improvement in Mills for Grinding Quartz;* Horatio Blasdell, City of New York, January 20.

"The distinguishing feature of improvement consists in so constructing and combining the several parts of the mill, that the quartz rock shall be received and cracked or reduced so as to pass between the grooved surfaces of the semi-spherical runner and concave, wherein the quartz is held, and the particles thereof made to act by friction directly upon each other, and thus effect its own pulverization, and allowed to descend gradually to circular channeled rings, between whose surfaces the quartz is reduced to the fineness of flour."

Claim.—"Having thus described my mill for reducing gold quartz rocks to a powder or flour, what I claim as new is, the combination of the chilled hollow cylinder R^2, and nut S, of the form represented, and the grooved chilled rings W E^2, and horizontal circular channeled chilled ring plates R X, with the grooved concave E, and runner T, for breaking, pulverizing, and powdering gold quartz rock; the said chilled rings and plates being arranged and operating in the manner and for the purpose herein fully set forth."

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50. For an *Improvement in Churns;* Edwin B. Clement, Barnet, Vermont, January 20.

Claim.—"What I claim as my invention is, the application to dashers for churns, of floats that shall close together at their appointed place, when pressed downwards through the cream or milk, forcing the cream or milk through narrow spaces, and opening again when raised from the bottom; claiming the right of composing the dasher of any materials, and in any combination of the above described parts, so as substantially to produce the same effects."

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51. For an *Improvement in Machines for Drilling Stone;* Henry Goulding, Boston, Massachusetts, January 20.

"My improved machine is intended to be used either as a power or hand drilling machine, and is so constructed as to drill in any direction, the drill being set in a swinging frame, and operated by the friction of two sets of grooved wheels, with movable journals, so placed with regard to each other as to turn the drill as it is driven."

Claim.—"Having thus described my improved drilling machine, what I claim as my invention is, 1st, driving the drill forward and back by adjustable wheels, between the edges of which the drill shaft is placed, substantially as above described.

"2d, I claim turning the drill, by placing said wheels at an angle to each other, substantially as herein above described.

"3d, I claim feeding the drill forward, as the hole is deepened, by making the bearing surface of the wheels which drive the drill in, of greater strength than that of the other wheels."

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52. For an *Improvement in Washing Machines;* John McLaughlin, Goshen, Ohio, January 20.

Claim.—"Having thus fully described the nature, construction, and operation of my improved washing machine, what I claim therein as new is, the method of hanging and operating the plunger, by means of the shackles and the heavy counterpoise handle, as described."

53. For an *Improvement in Hand Printing Presses;* Henry Moeser, Pittsburg, Pennsylvania, January 20.

"The object of the represented arrangement is to avoid the sliding motion of the platen, as it is most generally the case with hand presses; for that purpose, the tympan plate is constructed movable around the hinges, and the impression effected from below, by pressing the platen with the types against the tympan, as will be shown."

Claim.—"What I claim as my invention is, the tympan plate of a printing hand press, removable by hinges, and counterbalanced, together with the manner of holding the tympan plate in its position, (when lowered down,) for the purpose of resisting effectually the pressure exercised from below, substantially as described."

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54. For an *Improvement in Spinning Machinery;* Oliver Pearl and Henry P. Chandler, Lawrence, Massachusetts, January 20.

Claim.—"But what we do claim as our improvement is, the arrangement of the whirl at the base of the flyer, in combination with making the said whirl and the bearing on which the whirl is placed and rotates, with a passage through them large enough to allow the bobbin to play within the same, and up and down between the flyer legs, substantially in manner and for the purpose as specified."

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55. For an *Improvement in Self-Sharpening Grindstones;* Jesse Pennabecker, Elizabeth Township, Pennsylvania, January 20.

Claim.—"What I claim as my invention is, the combination of a grindstone with a self-acting picker, by which the grindstone is sharpened by its motion or power, as herein described, or in any other manner substantially the same."

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56. For *Improvements in Nail Machines;* Samuel G. Reynolds, Worcester, Massachusetts, January 20.

"The object of my invention is to avoid the difficulties heretofore encountered in the manufacture of wrought iron nails, and consists in the employment of cutters to sever tapered pieces, by cutting from a plate, rolled to the required thickness of the thickest part of the shank of the nails, and making the taper alternately from opposite sides, and so proportioned that the cross section, taken at any part of the shank, shall have the same or nearly the same amount of metal after the cut, and when the nails are completed, when this is combined with griping or moulding dies, which receive the cut pieces from the cutters by some suitable conveying means, and which mould them by causing the metal to spread, instead of elongating, and retain the same or nearly the same amount of metal in any and all parts of its length."

Claim.—"Having thus described my improved method or process of making wrought nails, and the machinery for the same as I have essayed it, I wish it to be distinctly understood, that it is susceptible of modifications, as for instance, instead of making an active pressure on all four faces of the blank, to give the required form, the same thing may be accomplished, although not so well, by making active pressure on two faces, and simply presenting resistance to the other two faces.

"What I claim as my invention in the making of wrought nails is, the employment of the cutter for cutting wedge-formed pieces from a previously rolled plate, of equal or nearly equal thickness, substantially as described, preparatory to and in combination with the moulding dies which receive the cut pieces, by suitable conveying apparatus, from the cutters, and mould them to the required form by pressure, substantially as specified, so as to give the form by spreading the metal between the dies, instead of by elongation, as heretofore practised when making nails from cut blanks.

"I also claim the vibrating cutter, and the faces or dies for confining and compressing the nails arranged on both sides of the said cutter, substantially as described, when this is combined with the two stationary cutters, having a space between the two, through which the rod or plate of iron is fed, substantially as described."

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57. For an *Improvement in Brick Kilns;* William Linton, Baltimore, Maryland, January 20.

"My improvements consist in the form of the bottom of the fire arches, and in the mode

of introducing the air into the furnace, for igniting and burning the fuel, and causing a free, steady, and unimpeded heat, equalized throughout the body of the kiln, by which I am enabled to greatly economize the fuel, and burn a kiln of bricks, or other articles manufactured of clay, more evenly and expeditiously than by any other mode with which I am acquainted."

Claim.—"Having thus fully described my improvements, what I claim therein as new is, forming air arches or openings in the kiln, between the fire beds, with lateral openings therein, through which a sufficient amount of air can be supplied equally to all parts of the fire bed at the same time, substantially as herein described."

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58. For an *Improved Cast and Wrought Iron Blind;* Robert White, Washington, District of Columbia, January 20.

Claim.—"I do not claim the combining cast and wrought iron, nor do I claim to be the first to have cast metal round cold metal, and joining the same by that means; but what I do claim as new is, producing a new product or article of manufacture for shutters, doors, &c., whereby I am enabled to use wrought iron slats, and prevent the contraction of the metal, in cooling, from warping the same, by casting the top, centre, and bottom plates separately and distinct from the side plates, and running the side plates to the slats and plates, substantially as herein set forth."

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59. For an *Improvement in Piano Forte Action;* Geo. Brown, Assignor to Geo. Brown and John Munro, Boston, Massachusetts, January 27.

Claim.—"I therefore claim in the upright piccolo piano forte action, the arrangement of the back catch lever L, in front of the back catch, and so that the rear side of the bearer shall operate in connexion with the front side of the back catch."

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60. For an *Improvement in Sand Paper Holder;* Azel H. Copeland, West Bridgewater, Massachusetts, January 27.

Claim.—"Having thus described my invention, I shall state my claim as follows: what I claim as my invention is, the implement called a sand paper holder, constructed substantially as above described; that is, of two similar pieces of wood, with handles at the ends, the inner sides flat, and the other sides rounded, joined together lengthwise by a hinge of cloth or leather, so that the flat sides can be brought together; the outer edges of the flat sides having small wire pins inserted in them, by which the sand paper is held, and the two pieces being held together, when closed by dowels in one of the flat sides entering corresponding holes in the other flat side."

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61. For an *Improvement in Mill Spindles;* Egbert T. Butler, Buffalo, New York, January 27.

"My invention relates to spindles for mills, in which the runner stone is held to its work by pressure, and consists in making and uniting the parts of the spindle where they connect to the driver, and connecting them to the driver in such a manner as to secure solidity, compactness, durability, and ease of operation, by the means hereinafter described."

Claim.—"Having thus fully described my invention, I claim, 1st, Uniting the upper and lower parts of the spindle, by means of the driving chuck or key, made substantially in the manner and for the purposes herein set forth.

"2d, I do not claim the vibrating centre separately, but I do claim it in combination with the driving chuck or key, and the method herein described, of uniting the parts of the spindle."

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62. For *Improvements in the Ring Spinner;* Geo. H. Dodge, Attleborough, Massachusetts, January 27.

Claim.—"What I claim as my invention is, the combination of the standard or projection B, with the ring and traveler, substantially in manner and for the purpose of removing or loosening waste from the latter, as specified."

63. For *Mechanism for Operating the Relief-Valve in Partially Condensing Engines;* William Few, St. Louis, Missouri, and Francis Armstrong, New Orleans, Louisiana, January 27.

Claim.—"Having thus described the construction and operation of our invention, what we claim therein as new is, the arrangement and combination of the partial escape or relief-valve W^2, plate Z, reciprocating lifting box Y, connecting rod *j*, crank lever X, and rock shaft T, whereby the said relief-valve W^2, is actuated simultaneously with the opening of either of the exhaust valves, and allowed to close again, as herein set forth."

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64. For an *Improvement in Cooking Ranges;* John P. Hayes, Boston, Massachusetts, January 27.

Claim.—"Having thus described my improvements in cooking ranges, I shall state my claim as follows: What I claim as my invention is, the combination of the pipes, arranged with fire spaces between them, with the hot air flues and driving flues of the brick work on the back and side of the oven, by which hot air is circulated through the oven, and back again to the chamber about the fire pot, and so on continuously, this hot air being used either for baking or for heating the apartments of the house.

"2d, I claim the use of swing doors, arranged one on each side of the front of the fire pot, serving for radiating surfaces, in connexion with the said front of the fire pot, for roasting purposes, and to admit the cold air when opened, as herein above described and set forth."

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65. For an *Improvement in Water Metres;* Samuel Huse, Boston, Massachusetts, January 27.

Claim.—"What I claim as my invention is, combining with a cylindrical case, such as herein described, and provided with induction and eduction passages, and with a segmental stop and leather cap plate, for packing, substantially as described, a series of hinged segmental pistons, hinged to arms projecting from a central shaft or hub, and hinged at about one-third of the distance from their inner ends, so that when thrown open, their outer ends shall not bind against the inner periphery of the cylinder, and when closed to pass the segmental stop, they shall be sustained by a rest projecting from the central shaft or its equivalent, having a space between them and the shaft and arms for the free flow of water, or other fluid, under the said pistons, to admit of their closing freely; the whole being made and combined substantially in the manner and for the purpose specified."

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66. For an *Improved Nail Plate Feeder;* Caleb Isbister, Allegheny City, Pennsylvania, January 27.

Claim.—"What I claim as my invention is, 1st, The giving to the nail plate, an interrupted rotary motion in the same direction, instead of the reciprocating, partially rotating motion in opposite directions, usually given to said plate, and this I claim irrespective of the mechanical devices by which said motion is communicated.

"2d, I claim the combination of the sectional cog-wheel always moving in the same direction with the cylindrical cog-wheel, having irregular teeth, working between guides, having a mouth piece, and with the springs and spring plate, or their equivalents, by means of which, both an interrupted rotary and a rising and a falling motion is communicated to the nail plate.

"3d, I claim giving a continuous forward and an interrupted forward and backward motion to the nail plate, by means of the revolving shaft, screwed tube, cam and guide pin, and nut, *w*, combined with each other substantially as herein described."

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67. For *Improvements in Iron Railings;* Benjamin Kraft, Reading, Pennsylvania, January 27.

Claim.—"What I claim as my invention is, the method of constructing a self-adjusting and fastening fence, by forming the posts in two pieces, substantially such as herein described, making two sides of one part of the post, with mortises at the top and near the bottom, for the reception of the rails, and the other piece, when in place, retaining them in position.

"I claim the tongues, I I, connecting the hollow cap J, provided with a tongue K, and groove K, with the uprights, or panels, *o o*, said tongues passing between the rails, and with the cap J, serving as a hook to sustain the uprights or panels."

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68. For an *Improvement in Railroad Switches;* Abm. S. Miller, Republic, Ohio, January 27.

Claim.—"Having described the nature of my invention, what I claim is, placing the tumbler, figures 4 and 5, under the rails L and K, in such a manner as to ease their movement, and when at rest, operating as a brace, or key, to retain the rails in place."

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69. For *Improvements in Fire-Arms;* Charles V. Nickerson, Baltimore, Maryland, January 27.

Claim.—"Having thus described my improvement in fire-arms for loading at the breech, where the barrel is banded or secured to the stock, I wish it to be understood that I make no claim to being the original inventor of a fire-arm, or gun, loaded at the breech, such as that patented in France, to Mr. Tourrette, of Paris, on the 24th November, 1834, described in "*Brevets d'Inventions, Vol.* 55," and in descriptions of other guns which are loaded at the breech, patented and unpatented; but what I do claim as new is, dividing the stock at the junction of the barrel and breech, and mounting the barrel and that portion of the stock to which it is attached, with a sheath or case, upon a longitudinal bar or tongue, projecting from the but of the stock, as represented in the drawings, whereby the stock and barrel are allowed to have a movement from the breech, for inserting the cartridge into the chamber thereof, and returned and locked by a catch to confine them together."

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70. For an *Improvement in Shingle Machines;* Luther B. Parker, Pine Township, Pennsylvania, January 27.

"The nature of my invention consists in an improvement in Woods's patent self-feeding shingle machine, for cutting and jointing shingles; this improvement consists in this—I do not use the machinery for self-feeding, but in my improvement you feed by hand."

Claim.—"What I claim as my invention is, the application of the vibrating and gauging the shingles. The shingle blocks are laid on the bench, and are pressed against the vibrating rod, one end resting against the centre panel of the knife sash; then as the sash moves up and down, the shingles are cut off the block and finished at one stroke of the machine, while the block can be turned at leisure, to suit the grain of the wood."

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71. For *Improvements in Ships' Davits;* Charles Perley, City of New York, January 27.

Claim.—"I do not claim any of the separate parts themselves, but I do claim as new and of my own invention, the application of the socket *d*, on its hinge 5, in combination with the socket *c*, and davit *e*, for the purposes and as described and shown."

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72. For an *Improvement in Neck Yokes;* John T. Plato, Jasper, New York, January 27.

Claim.—"Having thus described my invention, what I claim therein as new is, the combination of the washers C, the swivel B or E, bolt *a*, and nut D, with the ordinary neck yoke, arranged in the manner and for the purpose herein set forth."

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73. For an *Improvement in Railroad Switches;* Ira Reynolds, Republic, Ohio, January 27.

"The nature of my invention consists in attaching radial links, or arms and swiveled levers, to the stay bar connecting the switch rails, in such a manner as to secure a perfect change, and lock for the same."

Claim.—"I do not wish or intend to claim the placing or attaching of links, arms, or tumblers, under the switch rails, or stay bars, for the purpose of carrying them over; but what I do claim is, 1st, the attaching of the links or arms to the stay bar, or switch rails, and superstructure, for the purpose of holding the switch rails against the undue action of the levers, and securing them in a perfect and uniform motion, when acted upon by the

levers, also to act as a stay or lock, which shall effectually hold and secure the switch rails, in every position, substantially as set forth.

"2d, I claim a combination of the pivoted levers, furnished with peculiar formed ways, with the operative shoe, so constructed and arranged, that the switch rails are moved upward and laterally, in manner substantially as described."

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74. For an *Improvement in Windlasses;* Amzi C. Semple, Cincinnati, Ohio, January 27.

Claim.—"What I claim as my invention in the above described press is, winding the rope upon a screw with a concave score between the threads, that fits the rope and supports it in its proper form, thereby lessening the wear of the rope and its liability to be broken, in the operation of pressing, when the said screw is made to work through a fixed nut, so as to always draw the rope in the same position, substantially as described."

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75. For an *Improvement in Shears;* John C. Symmes, West Troy, New York, January 27.

"This invention relates to an improvement in the pivot, by which the edges are drawn together sideways, in cutting, and all inconvenience arising from the looseness of the pivot, in ordinary scissors and shears, is effectually remedied."

Claim.—"What I claim as my invention is, making the pivot and the hole in one or both limbs in which it fits, of such form as exemplified at O, as to cause the edges of the blades to be drawn together sideways, by the power applied in cutting, as herein fully set forth."

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76. For an *Improvement in File Cutting Machines;* James H. Thompson, Paterson, New Jersey, January 27.

Claim.—"What I claim as my invention is, 1st, the traveling and revolving elongated elliptical cam, in combination with the connecting rod or its equivalent, communicating a varying amount of motion to the rock shaft, which motion is conveyed, through suitable mechanism, substantially such as is described, to the screw, by means of which a varying rate of travel is communicated to the chisel.

"2d, The inclined plane, or its equivalent, in combination with a jointed chisel stock, or its equivalent, pressed against said plane by the spring, or its equivalent, substantially as described.

"3d, The springs, or their equivalents, to press the axis of the stock into the scores in the sliding bar.

"4th, The springs, or slide and spring, whether used separately or combined, to press the cross against the pillars, so that the file may remain upon the bed, in that position in which it is placed, by one stroke of the chisel, until it is struck again, thereby dispensing with the roller heretofore used to press the file against the bed."

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77. For *Improvements in Machines for Making and Sizing Paper;* Geo. W. Turner, London, Great Britain, January 27.

Claim.—"What I claim as my invention is, 1st, the application of the endless wire web, in combination with and passing round the cylinder, and taking the pulp up from the vat, and carrying it forward, and submitting it to the action of the dandy roller and pneumatic trough, taking the place of the fixed wire web and endless felt in the cylinder machines now in use, and the wire web upon which the pulp flows in the above mentioned Fourdrinier's machine. I am aware that a somewhat similar combination is found in Millbourn's machine, reported in *Repertory of Patent Inventions*, 5th Series, Vol. 9, p. 325, dispensing with the cylinder D; but that I do not claim.

"2d, I claim the method of passing the paper through a trough of size, between two endless felts, or other fabrics, as above described, thereby obtaining a perfect and uniform saturation of the paper, and protecting the paper from all injury, during the process of sizing and pressing."

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78. For an *Improvement in Burglar Alarms;* L. J. Worden and E. H. Space, Clinton, New York, January 27.

Claim.—"We do not claim the clock movement, as that is a well known and old inven-

vention; neither do we claim the lever K, for the purpose of operating upon the pallet F; but what we do claim as new is, the securing of the lever K, after it has been moved by the button M, so as to allow the pallets F, F, to be acted upon by the 'scape wheel D; said lever K being secured by the end *m*, of the lever, N, fitting in a groove or recess, *o*, in the end *j* of the lever K, the end *m* being forced into the groove or recess *o*, by the spring *n*, substantially as shown and described."

Re-issue for January, 1852.

1. For an *Improvement in Planing Machines;* Charles A. Spring and Peter Boon, Kensington, Pennsylvania; patented July 30, 1850; re-issued January 13, 1852.

Claim.—"Having thus fully described our improved machine, we wish it to be understood, we do not claim a bench that can be raised and lowered by set screws, or similar device; but what we do claim as our invention is, 1st, hinging the bed-piece at one end, and raising and lowering it at the other, in combination with the revolving cylindrical cutter, in the manner and for the purpose set forth.

"We also claim the combination and moving of the feed rollers (*g'*) with the stationary ones, by the oblique links and gear, as described, the whole being constructed and operating as before specified."

Designs for January, 1852.

1. For a *Design for Stoves;* James G. Abbott and Archelus Lawrence, Philadelphia, Pennsylvania, January 6; ante dated December 11, 1851.

Claim.—"What we claim as new and of our invention is, the design or ornament, shape and configuration of stove plates, as represented in the annexed drawings at D E F, figs. 1, 2, 3."

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2. For a *Design for Stoves;* James G. Abbott and Archelus Lawrence, Philadelphia, Pennsylvania, January 6; ante dated December 11, 1851.

Claim.—"Having thus described and represented our new design of stove plates for "the Complete Cook," what we claim as new is, the design and configuration of ornamental stove plates, substantially as described and represented at A B C D E F G H I J, of the accompanying drawings."

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3. For a *Design for Stoves;* Sanford Burnam, Waterford, New York, January 6.

Claim.—"Having thus described the design of my stove, what I claim is, the design and configuration of ornaments, arranged and combined substantially the same as represented."

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4. For a *Design for Spoons;* Henry Hebbard and John Polhamus, City of New York, January 6.

Claim.—"Having now described our invention of a new and ornamental design for spoons or other articles, what we claim as our invention is, the use of the ornamental design, substantially as herein set forth, for the purpose of ornamenting spoons, forks, or other articles to which it may be applied."

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5. For a *Design for Stoves;* William Savery, City of New York, January 6.

Claim.—"What I claim as new and original is, the design and configuration of the several ornamental figures on the front and bottom plates of a certain stove, as represented in the annexed drawings and as above described."

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6. For a *Design for Stoves;* J. Harvey Conklin, Peekskill, New York, January 6.

Claim.—"What I claim as my invention is, the configuration and design of the several ornaments and their mouldings, particularized on the front, sides, doors, legs, and feet of the stove, formed and arranged as depicted and described."

7. For a *Design for Stoves;* James Wager, David Pratt, and Volney Richmond, Troy, New York, January 13.

Claim.—"Having thus fully described our design, what we claim therein as new is, the foregoing described configuration of the plates, forming an ornamental design for a stove, as represented and illustrated by the drawings."

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8. For a *Design for Floor Oil Cloth;* James Paterson, Assignor to James Allen, Elizabethtown, New Jersey, January 13.

Claim.—"What I claim as my invention is, the representation of trunks of trees and andscape, as in the accompanying drawings, for a design for floor oil cloth."

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9. For a *Design for Coal Stoves;* John Burgess, Assignor to Geer, Chaffee & Richmond, Troy, New York, January 13.

Claim.—"Having thus described and represented my new design, what I claim is, the design and configuration of a cast stove, substantially the same as described and represented in the annexed drawing."

FEBRUARY, 1852.

1. For an *Improvement in Hemp Brakes;* Lewis S. Chichester, Williamsburgh, New York, February 3.

Claim.—"What I claim as my invention is, making two or more breaking and cleaning cylinders, with fixed rods at or near their peripheries, and radial plates made to slide radially, (or some of them fixed,) operated substantially as herein described, in the spaces between the rods, substantially as described; the two or more cylinders being geared together so as to turn with equal velocities, and so placed, that in their rotation, the rods and plates of one cylinder shall come opposite to those of the other cylinder, for the purpose and in the manner substantially as set forth.

"And I also claim the combination of springs substantially as described, with the sliding plates of the cylinder or cylinders, operated substantially as herein described, for the purpose of rendering the plates self-adapting to the material introduced, and insure its being properly griped, and held so as to admit of slipping, without undue strain on the fibres, as described."

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2. For an *Improvement in Grass Burners;* John A. Craig, Columbia, Arkansas, February 3.

Claim.—"What I claim as my invention is, the application to the surface of the ground, flame for agricultural purposes, using for that purpose, the above described machine, or any other substantially the same, which will, by heat, produce the intended effect."

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3. For an *Improvement in Feeders for Planing Machines;* Jno. Cumberland, Mobile, Alabama, February 3.

"This machine as constructed, is composed of two general parts: The first consists of a stationary plane or bed-piece; and the second of a movable platform, which is subject, for the purposes of description, to further division, as will appear hereafter."

Claim.—"What I claim is, my above described combination of a bed-piece with the spring, lever, connecting rod, arm, tumbler and clicks, and its grooves, guides, and rack, with a movable platform, with the adjusting levers and ratchets, for the production of a lateral traverse and lost motion, with its adjustable table, adjusted by springs, weights, screws, or other known means, with its hand wheels, rollers, vertical ratchets, and balance clicks, and of a frame with its pully and half wheel, for the purpose of delivering or receiving material thereon; the whole being constructed, combined and operating as above set forth and described, and for the purposes mentioned."

4. For an *Improvement in Street Sewers;* Willard Day, Brooklyn, New York, February 3.

Claim.—"Having thus described the nature of my invention, and the manner in which it operates, what I claim as new is, the combination of the basin placed at the bottom of the inclined drain, and at the side of the sewer, with a single man hole, so placed as to give access to the basin and sewer."

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5. For an *Improved Door Spring;* Henry Hochstrasser and Abrm. Masson, Philadelphia, Pennsylvania, February 3.

Claim.—"We do not claim the straight piece of steel for a spring, as new, neither do we claim having the spring act most powerful when the door is closed as new; what we do claim as new and our invention or improvement is, the application and mechanical arrangement of a curve, in connexion and combination with a spring and rollers, for the purpose of a door spring, whose power will be exerted more strongly when the door is closed, or about closed, than when open entirely or partially, as herein described."

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6. For an *Improvement in Gas Purifying Apparatus;* Abram Longbottom, City of New York, February 3.

"My invention relates to certain improvements in the method of purifying illuminating gas, whereby the washing apparatus is wholly done away with, so that the gas comes from the retorts or furnaces, completely purified and ready for consumption,"

Claim.—"What I claim as my invention is, purifying the gas, by passing it through a mixture of equal measures of quick lime and of animal charcoal, in the same retort in which the gas is generated, but at a temperature, so regulated, that at the lowest point, or where the gas enters the composition, the mass is at a lowered heat; and at the top, or where it leaves the composition, the heat is below redness, substantially in the manner herein set forth."

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7. For an *Improved Method of Keeping the Valves of Oscillating Engines upon their Seats;* Ephraim Morris, City of New York, February 3.

Claim.—"I claim the pressure plugs, or their equivalents, acting against the caps, or their equivalents, in combination with the steam chest, valve, and valve seat or seats, vibrating with the steam cylinder; said plugs operating to keep the valve or valves on to the seat or seats of the same, as described and shown."

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18. For an *Improvement in Axletree Arms;* David Philips, Sharon, Pennsylvania, February 3.

"The object of my invention is to obtain the advantages of wooden and iron axletrees in the same wagon, and it consists in a compound arm and cap, which is formed of metal, and is applied to the extremity of a wooden axletree, so that the wagon wheels rotate upon iron arms of small size, and, consequently, with a small amount of friction, while the elasticity of a wooden axletree, and the advantages incident thereto, are retained."

Claim.—What I claim as my invention is, constructing metallic arms for axletrees, with sockets and ribs, as herein set forth, so that the arm can be attached to the wooden stock, or body of the axletree, without the employment of the hoops, clips, and screw bolts heretofore employed, even when the stock is as small, or of less diameter than the arm."

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9. For an *Improvement in Concentrated Beer Material;* Franz G. Rietsch, Rudoletz, Austria, February 3.

Claim.—"What I claim as my invention is, the new and useful preparation of matter herein described, termed, Zeilithoid."

10. For *Improvements in Ships' Blocks;* William and Stephen G. Coleman, Providence, Rhode Island, February 3.

Claim.—"What we claim as our invention is, the method of making ships' blocks, by placing the metal straps edgewise, that is, with its greatest breadth in the direction of the plane of the axis of the sheaves, and extending from the sides of the sheave to the outside of the cheeks, substantially as specified, when this is combined with the attachment of the cheeks in segments to the wide faces of the straps, substantially as specified.

"And we also claim making the cheeks of ships' blocks in segments of a ring, substantially as specified, whereby the elongated form is obtained, by simply turning in a common lathe, whilst apertures are left each side of the straps, to give admission for cleaning and oiling, and for checking or stopping the sheave, as fully set forth."

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11. For an *Improvement in Running Gear of Railroad Cars;* Henry Davis Taylor, Newark, New Jersey, February 3.

"This invention relates to certain means of removing obstructions from the track, and preventing the cars, engine, or any carriages employed on railroads, from being caused to run off the track by any unevenness or obstruction, that does not admit of being easily removed, or by any other means."

Claim.—"I do not claim the grooved inclined wheels, J J, fitting to the rails in the manner described; but what I do claim as my invention is, the lower truck or frame, supported upon the rails, and prevented from rising, by grooved inclined wheels, fitting to the edge of the rails, and connected to the trucks and body of the car, by series of links and rods, substantially such as are herein described and represented, operating for the purpose set forth.

"And I also claim the forked guards provided with elastic bands, attached to the lower truck, so as to move up and down freely, but formed so as to take a firm bearing or rest on the front axle, or any stationary part of the front truck, when brought into contact with any obstruction, substantially as and for the purpose herein set forth."

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12. For an *Improvement in Running Gear of Carriages;* Charles F. Verleger, Baltimore, Maryland, February 3.

"The nature of my invention consists in an improved arrangement of the running gear of four-wheeled carriages, whereby I am enabled to produce a light and strong carriage, all four wheels being of equal size, which can be turned round with ease, and without danger of upsetting, in a space of about the diameter of one of the wheels."

Claim.—"Having thus fully described my improved running gear for four-wheeled carriages, and the advantages attained by the same over all others, when the object is to turn in as small a space as possible, without running the fore wheels under the body of the carriage, what I claim as new therein is, the combination of the segment plate *c*, and the perch *e*, sliding thereon and connected with the axles, as described, with the segment plate *h*, forming a part of the perch *e*, and the plate *i*, attached to the perch block of the body, and sliding on the plate *h*, in connexion with the rods *a a*, by which the other parts are regulated and governed in their action, constituting an arrangement of running gear, constructed substantially as in the manner herein fully set forth and represented."

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13. For an *Improved Steering Apparatus;* Norman W. Wheeler, Buffalo, New York, February 3.

Claim.—"Having thus described my improved steering apparatus, what I claim therein as new is, the combination of fast and moving circular racks, of different diameter, with corresponding planet wheels or pinions, connected together and actuated by the hand wheel, as herein set forth."

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14. For an *Improvement in Bridges;* Ammi White, Boston, Massachusetts, February 3.

Claim.—"Having thus described the whole construction of the bridge, I wish it to be understood, that I do not claim, separately, as new, the mode of constructing the stringers, by splicing and securing planks in the manner set forth and shown; nor yet do I claim, separately, the use of diagonal planking, crossed in layers, as described; nor yet, again, do

I claim, by itself, increasing the width of the roadway and other parts of the bridge at the ends; neither the mere employment of side guards or braces; as all these, or similar devices or applications, belong to common carpentry or ordinary bridge building; they, however, are necessary details, or contain principles essential to the construction of my bridge, involving a combination having the effects and advantages specified.

"But what I do claim as my invention is, 1st, The combination of parts, constructed and arranged as described, in formation of a wooden tubular suspension bridge; that is, the several suspension stringers D D, of catenary form, and constructed and united in pieces as explained, (the outer ends of the extreme stringers being locked, as represented in the back stays,) the stringers H H and I, for construction thereto or thereon of the inclined roof, made of diagonal planking; the roadway stringers G G, connected by suspension rods to D D and H H; the direct arch M, united by suspension rods, and further direct arch N, bearing under the upper stringers, together with the transverse floor timbers and roadway; the bridge thus constituted, being formed—that is, its stringers, arches, and coverings—of short pieces of wood, united, and having their fibres running in appropriate directions, as shown, and the bridge being in form wider at its extremities, gradually narrowing towards the centres; by which combination and arrangement of parts, the tensile strength of the wood in the suspension stringers is fully employed, vertical and lateral vibration are reduced, the roof more than assists towards the support of its own weight, and the bridge may be extended over a considerable space.

"2d, The continuous angular side guards formed by fender raves P P, inclined rafters Q Q, diagonal plank covering R R, and extensions of the transverse roadway timbers O O, the said side guards projecting most, and being of greatest extent at the extremities of the bridge, gradually diminishing towards the centre; and the specified side guards serving not only as braces to reduce the lateral motion, but as a covered roadway, and to break the effect of wind upon the structure."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Remarks on the Screw Steamship "City of Pittsburg." By Chief Engineer B. F. Isherwood, U. S. N.

The new steamship *City of Pittsburg*, bought to trade between Philadelphia and Liverpool, has made her first voyage out under steam, and on her return has had the misfortune to break the three blades of her screw propeller. Understanding it to be the intention of her owners to use different proportions for her new screw, it will be of interest to know the performance of the vessel with the old one. The dimensions given in this article were furnished me by her able Engineer; the results were taken from the steam log of the vessel.

HULL.

Length on Deck,	266 feet.
" Water Line,	249 "
Beam on Deck, extreme,	40 " 9 inches.
Depth of Hold,	32 " 6 "
Deep Load of Draft,	$22\frac{1}{2}$ feet forward. 23 feet mean. $23\frac{1}{2}$ feet aft.
Draft with coal half out,	$21\frac{1}{4}$ feet.
Immersed Amidship Section of vessel at $21\frac{1}{4}$ feet draft,	800 square feet.
Burthen, Custom House measurement,	3370 tons.

The hull was originally intended for paddle wheels, and was designed with flat floor and sides, not being the model proper for screw propellers.

ENGINES.

Two vertical trunk condensing engines.

Diameter of Cylinders,	85½	inches.
" Trunks,	39	"
Being equivalent to a cylinder having a diameter of	76·09	"
Stroke of piston,	51	"
Space displacement of both pistons per stroke,	267·392	cubic feet.
Mean effective steam pressure per square inch of piston,	10·4	pounds.
Total power developed by the engines,	777	horses.

SCREW.

One of cast iron; not a *true* screw, but twist bladed.

Diameter,	16 feet 2 inches.
Pitch at hub,	30 "
" periphery,	36 "
Mean pitch in function of total surface,	33 " 6 "
Fraction of pitch used,	0·563
Length on periphery,	5 feet.
" hub,	3 feet 2 inches.
Total helicoidal surface,	126 square feet.
Total surface projected on a plane at right angles to axis,	110·5 " "
Number of blades,	3.

RESULTS.

The vessel steamed from Philadelphia to Liverpool, in November, 1851. Total distance by observation, 3480 geographical miles of 6140 feet. Total time of steaming the above distance, 17 days, 4 hours, or an average of 8·447 geographical miles per hour. Total number of revolutions of the screw, 790,070, or an average of 31·96 per minute. Average steam pressure in the boiler, 10 pounds per square inch above the atmosphere; cut off at ⅘ths the stroke from the commencement. Throttle one-fourth open. Lift of valve reduced one-half. Vacuum in condenser, per gauge, 19 in. of mercury.

The weather throughout was fine, with an ordinary sea, and a moderate wind forward the beam. No sail set.

Total consumption of fuel, 519 tons, 1677 pounds, or 2825·8 pounds per hour of Cumberland (bituminous) coal.

SLIP OF THE SCREW.

Practically, the effective propelling portion of the screw is about that comprised between the diameters of 6 feet 2 inches, and 16 feet 2 inches, or the exterior 5 feet radially of each blade.

The average pitch of this surface in function of surface is 34 feet.

From the foregoing data, the slip of the screw will be as follows, viz:

8·447 × 6140 = 51864·58 = speed of vessel per hour in feet.
34 × 31·96 × 60 = 65198·40 = " screw " " "

13333·82 = slip of screw " " or 20·45 per cent.

BOILERS.

Three iron boilers, of the double return drop flue variety, placed side by side.

Total amount of heating surface,	8028 square feet.
" " grate "	226 " "
Aggregate cross area of upper row of flues,	28·4 " "
" " " middle " "	37·6 " "
" " " lower " "	28·4 " "
Area of smoke chimney,	37·6 " "
Height of chimney above grate,	59 feet 6 inches.
Consumption of coal per square foot of grate per hour,	12½ pounds.
Pounds of sea water evaporated per hour per pound of coal, inclusive of loss by blowing off, supposing the cylinder pressure to be 7 lbs. per square inch above atmosphere, caused by throttling,	4·93 pounds.

PROPORTIONS.

Proportion of heating to grate surface,	35·52 to 1·00
" heating surface per cubic foot of space displacement of both pistons,	3·00 "
" heating surface per cubic foot of space displacement of both pistons multiplied by number of double strokes of piston per minute,	0·94 "
" grate surface per cubic foot of space displacement of both pistons,	0·85 "
" grate surface per cubic foot of space displacement of both pistons multiplied by number of double strokes of piston per minute,	0·026 "
" cross area of upper row of flues to grate surface,	7·96 "
" " middle " "	
" " lower " "	7·96 "
" " chimney to grate surface,	6·01 "

The loss by "blowing off" has been calculated on the supposition that the water was carried at $\frac{2}{32}$ of Sewell's Salinometer, with which instrument the boilers were fitted. This is a maximum loss. The evaporation has also been calculated for only 3 lbs. *less* steam pressure in the cylinder than in the boiler; though the steam was wire drawn, both at the throttle, which was but one-fourth open, and at the valve, which had but half its proper lift.

The evaporation obtained of only 4·93 pounds of water per pound of coal, although exceedingly low, was what might have been anticipated from the above proportions, which gave a maximum of heating to grate surface, viz: 35·52 to 1·00, reducing the temperature of the gases delivered into the chimney so low, as necessarily to produce a very sluggish draft; while the proportion of *least* calorimeter, or cross area of flue, to grate surface was only 7·96 to 1·00; a proportion entirely too small, with the low velocity of draft, to supply the proper quantity of atmospheric air for combustion. The inevitable result of such proportions is, that the constituents of the coal is not fully oxidized, and of course a large portion of the products of combustion pass off in the form of carbonic oxide, instead of carbonic acid gas.

Boilers of such proportions should contain double the present amount of grate and heating surface, to supply these engines for driving a screw of the present pitch and surface, in which case a high rate of speed could be obtained.

The present mean effective pressure per square inch of piston is 10·4 pounds, with steam of 7 pounds initial pressure. Supposing now that steam were supplied of 14 pounds initial pressure in the cylinder, cutting

off at ⅓ths, as at present, and instead of the present vacuum in the condenser, the usual one of 26 inches were carried: the mean effective pressure per square inch of piston would then be 19 pounds; and as the number of double strokes made by the piston (with the same load) is as the square roots of the pressures on it, the double strokes would be increased in the proportion of 31·96 to 43·18, and the speed of the vessel increased from 8·447 to 11·41 geographical miles per hour. The consumption of fuel, with boilers of the same proportions as the present ones, (supposing enough of them to furnish the cylinders with steam of 14 pounds above the atmosphere, cutting off at ⅓ths,) would be just doubled, or equal to 60 tons of coal per 24 hours steaming. The time of making the passage would be reduced to 12 days, 17 hours, and the consumption of coal for the passage, instead of 520 tons, would be 762 tons.

It is very doubtful, however, if the engines are adapted for making 43 double strokes of piston; and a better result would probably be obtained by making a true screw of 37 feet initial pitch, expanding to 43 feet, being a mean of 40 feet, and adding another blade to compensate the effective surface lost by increasing the pitch, retaining of course the present length of screw on axis, or even increasing it by 6 inches, if practicable. The slip would then remain about the same as at present. The engines have so much cylindrical capacity that, with the increased pitch of screw, they could still, with the above consumption of fuel, develop sufficient power to make the passage in the reduced time stated.

It is of course understood, that the foregoing conclusions do not pretend to critical accuracy; but it is believed they are sufficiently near the truth for any practical purpose.

It has frequently been stated that high speed cannot be obtained with a screw propeller, and an instance challenged where speed has been given by it to a large vessel, equal to the speeds obtained from fast ocean steamships, like the Collins' and Cunard liners; but I think the results furnished from the *City of Pittsburg*, a vessel probably of equal resistance to the steamers of these celebrated lines, will be found as high, comparing them with the actual powers applied to the propelling instruments.

With the Collins' steamers, there is required to make a 10 days 20 hours passage from New York to Liverpool, a mean effective steam pressure of 19 pounds per square inch of piston, furnished by a consumption of about 83 tons of coal per 24 hours, cutting off at ⅓ths. The space displacement of both pistons per stroke is 888.03 cubic feet. Mean number of double strokes per minute, 14½. Allowing then the mean effective pressure in the cylinders of the *City of Pittsburg* to be 19 pounds per square inch, and the double strokes of piston per minute 43·18, the powers and results would compare as follows, viz:

	Powers.	Speeds.	Cube of Speeds, or Results.
Collins, . . .	1·115	1·039	1·122
City of Pittsburg, . .	1·000	1·000	1·000

The foregoing is, of course, but an approximation obtained from general data; but it is sufficiently close to demonstrate that the screw will, for ocean steamships of very deep draft, give equal speeds with equal power,

compared to the paddle wheel, provided it be properly proportioned and well managed.

The screw has never, to my knowledge, been tried in a first class ocean steamship, with any approximation to the power that is applied to the paddle wheels of such vessels; of course, the reason is obvious why as great speeds have not been obtained.

General Proportions of Power and of Surface of Screw to Immersed Amidship Section of Vessel.

Square feet of immersed amidship section of vessel per cubic foot of space displacement of pistons,		2·992 to 1·000	
Do.	do.	per cubic foot of space displacement of pistons multiplied by number of double strokes of piston per minute,	0·093 "
Do.	do.	per square foot of area of screw, viewed as a disk, ...	7·240 "
Do.	do.	per actual horse power developed by vessel,	1·030 "

For the Journal of the Franklin Institute.

A Series of Lectures on the Telegraph, delivered before the Franklin Institute. Session, 1850–51. *By* Dr. L. Turnbull.

Continued from page 111.

The House Printing Telegraph.

This instrument has been appropriately termed one of the wonders of the age; its apparent intricacy of construction arises not so much from the use of electricity and magnetism, as from the number of minute physical contrivances, and the various methods by which they are brought into action.

Of the origin and life of the inventor, Mr. Royal E. House, it seems difficult to obtain any definite or conclusive information; while the results of his labors are spread before the public, form a prominent object of its curiosity, and are made subservient in a high degree to its utility, the man himself seems almost a recluse, and veiled, as it were, from the sight of the world. If some tell us that he originated in New York, more authentic sources affirm that he was born in Pennsylvania, and reared among the Green Mountains of Vermont. To the old Keystone, then, may we ascribe the honor of having given birth to one who has achieved so much in the progress of American artizanship.

To converse and carry on intelligent discourse at the distance of many hundreds of miles, is not new; nay, it has become common; but to impress with the subtile electric spark through vast space, solid material, with the symbols of our language in the fulness of their proportionate beauty; to make the cold, dull, inanimate steel speak to us in our own tongue, surpasses the mythological narratives of ancient Greece and Rome, throws into the shade the fabulous myths of superstitious Arabia, and sinks into insignificance the time honored traditions of the Oriental World.

A letter dated Boston, Dec. 23, 1850, received in reply to some inquiries, relative to Mr. House, affords the following interesting information: "Mr. House is a self-educated man, and was engaged nearly six years in perfecting his instrument; he is decidedly scientific, but not learned,

having devoted much attention to electricity and its kindred sciences; observing the property of a helix or coil of wire to attract an iron bar to its centre, he proceeded to make some practical application of the fact, and succeeded in constructing what is termed an axial magnet; his principal object then, was the construction of a machine adapted for its use, which he fabricated after many attempts and much perseverance.

Such is the cast of his intellect, that he could form the entire object in his mind, and retain it there until he had completed its whole arrangement, without committing any thing to paper; somewhat abstract in disposition, he is careless about money, little communicative concerning himself, capable of long protracted thought, and completely absorbed in his hobby, the telegraph; to such an extent is this abstraction carried, that he often forgets his most faithful and punctilious business promises, and when sought after to comply with them, is found investigating some interesting object of science, or deeply engrossed in thought; even with particular friends he is very reserved about himself.

From some affection of the eyes he was confined to his dwelling during most of the time spent in contriving his instrument; he resides at present in New York. An application was made for a patent in 1845 or '46, but it was refused on the ground that some of the specifications clashed with those of Mr. Morse; one, however, was granted in October or November of 1848, to date from April 18, 1846.

The stations between which communications are conveyed, are connected by means of a circuit composed of one conducting wire, (see J, fig. 47,) and the ground; the wire is insulated to prevent escape of the electric fluid by enclosing it throughout its whole length in tubes of gutta percha: the heat of the sun melts this covering, or renders it so soft as to destroy its form, and it has been abandoned by all the lines except one; most of them employ, now as at first, the naked wire, supported on glass knobs fixed with bits of muslin to iron spikes driven into the post; they were formerly made of twisted wire and wound around glass knobs; thus exposed to the atmosphere, they soon became oxidized, requiring frequent repairs, or the lightning by striking them often played many pranks with the machines and their operators; the action of the current was also very unequal, owing to the varying electrical conditions of the atmosphere.

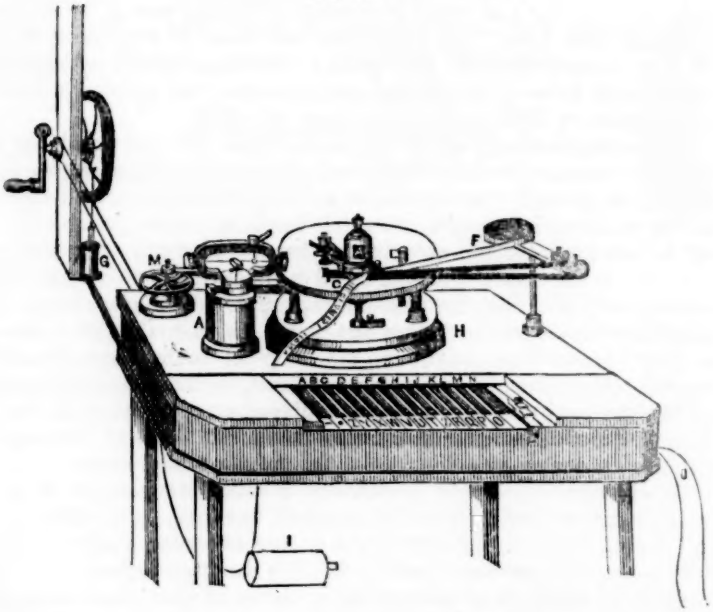
Notwithstanding all their precautions, a severe accident of the above nature, occurred to the House Telegraph in this City, on the 29th of May last; during a severe thunder storm in the afternoon of that day, the lightning, as was supposed, struck the line about six miles from the city; it destroyed nearly three miles of wire, melted off the helix of the magnet here, and terminated with a loud explosion at the battery; several gentlemen were sensibly and severely affected, and one of the operators, Mr. Alexander, received a heavy shock, causing vertigo, ringing in the ears, nausea, and temporary insensibility.

The posts to sustain the wire, are from 20 to 30 feet in height, set 5 feet deep, nine inches in diameter at the base, four and a half at the top, and about 15 rods distant from each other, that being the medium length which the kind of wire cited will support of itself and be durable; the Grove battery is employed to generate the current, of which about thirty cups are necessary for a distance of 100 miles.

The main constituents of his telegraph, are the composing machine, the printing machine, a compound axial magnet, a manual power which sets the two machines in motion, and a letter wheel or tell-tale, from which messages can be read when the printing machine is out of order.

A composing and printing machine are both required at every station; the printing apparatus is entirely distinct from the circuit, but all the composing machines are included in and form part of it; the circuit commences in the galvanic battery of one station, passes along the conductor to another station, through the coil of the axial magnet to an insulated iron frame of the composing machine, thence to a circuit wheel revolving in this frame; it then enters a spring that rubs on the edge of this circuit wheel, and has a connexion with the return wire, along which the electricity goes through another battery back to the station from whence it started, to pursue the same course through the composing machine and magnet there, and all others upon the line; thus the circuit is confined to the composing machines, axial magnets, conducting wires, and batteries.

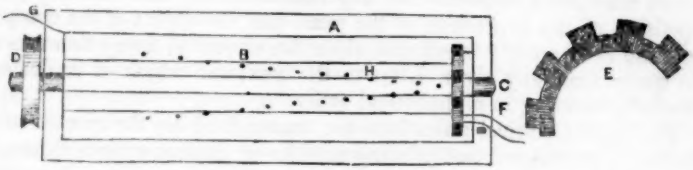
Fig. 47.



The composing machine Fig. 47, is arranged within a mahogany frame H, three feet in length, two in width, and six or ten inches deep; the various parts of the printing machine are seen on the top of the same case; both are propelled by the same manual power, which is distinct from the electric current; it is simply a crank with a pulley carrying a band to drive the machine, and a balance wheel to give stable motion; one of the spokes of the balance wheel has fixed to it, an axis for the end of a vertical shaft to revolve on, that moves the piston of an air condenser G, fastened to the floor; the air is compressed in the chamber I, fourteen inches long,

and six in diameter, lying beneath the mahogany case H; it is furnished with a safety-valve, to permit the escape of redundant air not needed in the economy of the machine.

Fig. 48.



The composing system has an insulated iron frame A, Fig. 48, placed immediately below the keys, parallel with the long diameter of the case; this has within it a revolving shaft C; the shaft is enclosed for the greater part of its length by the iron or brass cylinder B; it is made to revolve by a band playing over the pulley D, fixed to the left extremity of it. The cylinder is detached from the shaft, but made to revolve with it by a friction contrivance, consisting of a spiral spring arising from the shaft and pressing against the interior of the cylinder; the spring runs the whole length of the shaft: Fig. 49, shows a transverse section of it; the object of this is to allow the shaft to revolve, while the cylinder can be arrested.

Fig. 49.

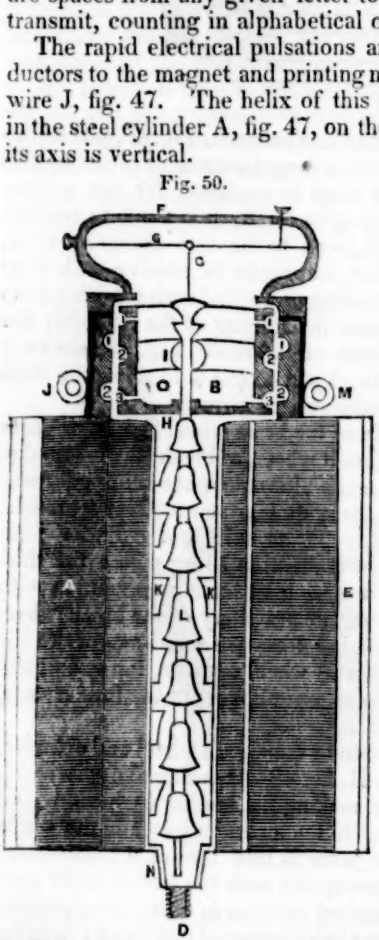
On the right end of the cylinder, is fixed the brass wheel E, Fig. 48, four or five inches in diameter, called the circuit wheel, or break; the outer edge of it is divided into 28 equal spaces, each alternate space being cut away to the depth of one-fourth of an inch, leaving fourteen teeth or segments, and fourteen spaces, Fig. 48, E; the revolving shaft and cylinder form part of the electric circuit; one point of connexion being where the shaft rests on the frame, the other through a spring F, having connexion with the other end of the circuit, pressing on the periphery of the break-wheel E; G, the other part of the circuit coming from the axial magnet to the frame A; if the shaft, cylinder, and circuit wheel revolve, the spring will alternately strike a tooth and pass into an open space; in the former case, the circuit is closed, in the latter it is broken.

For the purpose of arresting the motion of the circuit wheel and cylinder, the latter has two spiral lines of teeth H, fig. 48, extending along its opposite sides, having fourteen in each line, making 28, one for each tooth, and one for each space on the circuit wheel; the cylinder extends the whole width of the key board above it; the latter is like that of a piano-forte, containing twenty-eight keys that correspond with the twenty-eight projections on the cylinder, and have marked on them in order, the alphabet, a dot, and dash, Fig. 47; they are kept in a horizontal position by springs; there is a cam or stop fixed to the under surface of each key directly over one of the projections on the cylinder; these stops do not meet the teeth unless the key is pressed down, which being done, the motion of the cylinder is stopped by their contact; by making the circuit wheel revolve, the circuit is rapidly broken and closed, which continues until a key is depressed; that key being released, the revolution continues until the depression of another key, and so on; the depression of a key either keeps the

circuit broken or closed, as it may happen to be at the time, so that the operator does not break and close the circuit, but merely keeps it stationary for a moment; from one to twenty-eight openings and closings of the circuit take place between the depression of two different keys, or the repetition of the depression of the same one; the object of the composing machine is to rapidly break and close the circuit as many times as there are spaces from any given letter to the next one which it is desired to transmit, counting in alphabetical order.

The rapid electrical pulsations are transmitted by the circuit of conductors to the magnet and printing machine at another station, through the wire J, fig. 47. The helix of this magnet is an intensity coil contained in the steel cylinder A, fig. 47, on the upper surface of the mahogany case; its axis is vertical.

Fig. 50.

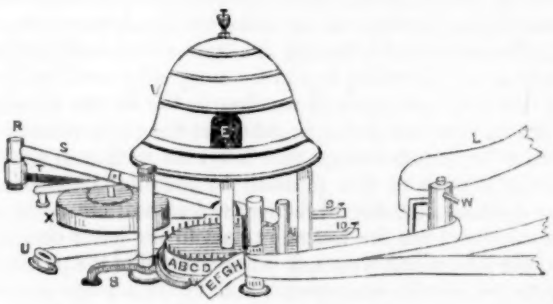


A, fig. 50, is a brass tube, eight or ten inches long, placed within the helix, and fastened at the bottom by the screw D. To the inner surface of this tube are soldered six or eight soft iron tubes, separated from each other at regular intervals. Above the steel cylinder is an elliptical ring, F, through the axis of which is extended an elastic wire, G; two screws are attached to the wire, by which it is made lax or tense, to suit the intensity of the electric current. From this is suspended the brass rod, C, that passes down within the small iron tubes before mentioned, and has strung on it six or eight small iron tubes, L; these are fastened at equal intervals and have their lower extremity expanded into a bell-like flanch; the surrounding fixed ones have their upper ends enlarged inwardly in the same manner. The tubes, L, and the wire to which they are fastened, are movable, so as to come in contact with the small exterior iron tubes K, fig. 50, but are kept separate by the elastic spring above. At E is the brass covering. On the transmission of an electric current through the helix, the tubes become magnetic. Such is the arrangement of their polarities, that they act by attraction and repulsion, overcome the elasticity of the spring, and bring the movable magnets down to the fixed ones;—the current being broken, the spring separates them. The two flanches do not come in direct contact, though the movable one acts responsive to magnetic influence. Most of the magnetism exists at the

flanches, and the order is such that the lower end of the inner tube has south polarity, the surrounding one above, the same, which repels it, while the top of the surrounding one below has north polarity, and attracts it;—this movement is through a space of only one-sixty-fourth part of an inch.

On the same rod, above the movable magnets, is fixed a hollow cylindrical valve, having on its outer circumference the grooves 1, 2, 3, fig. 50, The plate represents a longitudinal half-section of the valve, magnets, and helix. The valve slides in an air chamber, H, which has two grooves, 1, 2, on its inner surface. Air is admitted through the orifice I, by means of a pipe from the air chamber beneath the case, into the middle groove of the valve. The grooves of the chamber open into the side passages J and M, which connect at right angles with a second chamber, in which a piston moves. The movement of the magnets changes the apposition of the grooves in the first chamber, by which air enters from the supply pipe, through one of the side passages, into the second chamber, at the same time that air on the other side of the piston in the second chamber escapes back into the grooves 1 and 2 of the valve, through the other side passage, and from them into the atmosphere. This causes the piston to slide backward and forward with every upward and downward motion of the valve.

Fig. 51.



This piston moves horizontally, and is connected with the lever, 8, Fig. 51, of an escapement, the pallets of which alternately rest on the teeth of an escapement wheel of the printing machine A, Fig. 51. This part of the apparatus is arranged on a circular steel plate, twelve or fourteen inches in diameter, supported by standards on the mahogany frame, H, Fig. 47. The escapement wheel revolves on a vertical shaft that passes through the steel plate, and has fixed on it there a hollow pulley. This pulley contains within it a friction apparatus, precisely similar to that in the cylinder of the composing machine, and is driven by a band running around another pulley, (M, fig. 47.) The pulley can be made to revolve constantly, while the shaft and escapement wheel may be stopped. The escapement wheel has fourteen teeth, each one of which causes two motions of the escapement, which will make twenty-eight for a single revolution of the wheel, which is shown in fig. 52.

Fig. 52.

When in operation, the piston to which the escapement arm 8, fig. 51, is attached, is subjected, on one side or the other, to a pressure of condensed air; therefore the piston and escapement will only be moved by the escapement wheel when the air is removed from one side or the other of the piston. The position of the valve, fig. 50, attached to the magnet regulates the pressure of air on either side of the piston, by opening one or the other of the side passages into the second chamber. By breaking and closing the circuit, therefore, the piston and escapement move backward and forward; thus a single revolution of the circuit wheel at one station opens and closes the circuit twenty-eight times, causing an equal number of movements of the magnets in another station; they carry the valve which alternately changes the air on either side of the piston. This permits the escapement wheel to move the escapement and piston twenty-eight times, and allows one revolution of the escapement wheel for one of the circuit wheel at the transmitting station.

A steel type wheel, fig. 51, A, B, C, D, two inches in diameter, is fixed above, and revolves on the same shaft with the escapement wheel; it has on its circumference twenty-eight equi-distant projections, on which are engraved in order the alphabet, a dot, and a dash. The fourteen notches of the escapement wheel cause twenty-eight vibrations of the escapement in a revolution, that correspond to the characters on the type wheel. Every vibration of the escapement, therefore, makes the type wheel advance one letter; these letters correspond to those on the keys of the composing machine. If any desired letter on the type wheel is placed in a certain position, and a corresponding key in the composing machine is depressed, by raising that key, and again depressing it, the circuit wheel at one station, and the escapement and type wheel at the other station, all make a single revolution, which brings that letter to its former position. Any other letter is brought to this position by pressing down its key in the composing machine, the circuit being broken and closed as many times as there are letters from the last one taken to the letter desired.

To form the letters into words, it is necessary that the printing and composing machines should correspond, and for this purpose a small break and thumb screw, 9. 10, fig. 51, can be made to stop the type wheel at any letter. In sending messages, they usually commence at the dot; if, by accident, the type wheel ceases to coincide with the distant composing machine, the printing becomes confused, the operator stops the type wheel, sets it at the dash, and the printing goes on as before.

Above the type wheel, on the same shaft, is the letter wheel, E, fig. 51, on the circumference of which the letters are painted in the same order with those on the type wheel below. It is encased in a steel hood, having an aperture in it directly over where the letters are printed, so that when the type wheel stops to print a letter, the same letter is made stationary for a moment at the aperture, and is readily distinguished; hence messages can be read, thus making it a visual telegraph.

The type wheel has twenty-eight teeth arranged on the outer edge of its upper surface; near it, on the opposite side from where the printing is done, is the shaft T, fig. 51, revolving in an opposite direction. A steel cap,

X, fig. 51, two inches in diameter, is so attached to the top of this shaft that friction carries it along with it, but it can be moved in the opposite direction; it has a small steel arm, three-fourths of an inch long, projecting from its side, and playing against the teeth on the type wheel; while the latter is revolving, its teeth strike this arm, and give the cap a contrary motion to its shaft. There is a pulley on this shaft, below the plate, connected by a band to M, fig. 47; its speed is less than that of the type wheel. When the type wheel comes to rest, the arm falls between the teeth, but it has not time to do so when they are in motion. On the opposite side of the cap to where the arm is attached are two raised edges, called detent pins, against which the detent arm, U, fig. 51, alternately rests, as the position of the cap is altered by the small arm that plays on the teeth of the type wheel.

Between the type wheel and cap, is a small lever and thumb screw, 9, fig. 51, which acts as a break on the cap; its motion can be stopped by it, while the type wheel revolves; it is used merely to arrest the printing, though the message may be read from the letter wheel.

The detent arm revolves in a horizontal direction about the vertical shaft, which is also driven by a pulley beneath the steel plate; when the type wheel is at rest, the detent arm rests on one of the detent pins, but when it moves, the teeth on its upper surface give the arm and cap a reverse direction to its shaft, which alters the position of the detent points, so that the detent arm is liberated from this first pin, and falls upon the second, where it remains until the escapement and type wheels again come to rest; when this happens, the arm falls between two of the teeth, the cap resumes its first position, the detent is let loose, makes a revolution, and stops again on the first pin.

The shaft that carries the detent arm has an eccentric wheel R, fig. 51, on it, above the arm; an eccentric wheel is one that has its axis of motion nearer one side than the other, and while revolving, operates like a crank; from this eccentric is a connecting rod S, which draws a toothed wheel against the type; this toothed wheel is supported in an elastic steel arm, (shut out of view by the coloring band,) on the opposite side of the type wheel from that of the eccentric, and revolves in a vertical direction; the band E, fig. 47, carrying the coloring matter to print with, passes between this and the type; the dots seen represent small teeth that catch the paper and draw it along, as the wheel revolves, between itself and a steel clasp, operated by a spring that presses the paper againt the teeth and keeps it smooth; the clasp is perforated in such a manner that the type print through it; there are two rows of teeth, one above, the other below the orifice.

The vertical wheel, fig. 51, is embraced in a ring by the connecting shaft S, and a rotary motion is imparted to it by a ratchet fixed to its lower surface, moving with it and catching against two poles fastened to the steel plate below it; the poles are pressed against the ratchet by springs as shown in fig. 53; the wheel is octagonal, and every revolution of the eccentric, turns it through one-eighth of a revolution, and therefore presents a firm, flat surface to push the paper against the type, and advances sufficient for every letter, one being printed each time the detent arm revolves.

Fig. 53.

When the type wheel stops, the detent arm revolves, that carries with it the eccentric, which through the connecting rod draws the toothed wheel having the paper and coloring band before it against the type, and an impression is made on the paper; a letter is printed if the circuit remains broken or closed longer than one-tenth of a second; about one hundred and sixty letters in the form of Roman Capitals, can be accurately printed per minute; the roll of paper L, fig. 51, is supported on a loose revolving wire frame work; on the same standard is a small pulley W, around which one end of the coloring band runs.

In transmitting a message, the machine is set in motion, a signal is given, (which is simply the movement of the magnet,) and then with the communication before him, the operator commences to play like a pianist on his key board, touching in rapid succession, those keys which are marked with the consecutive letters of the information to be transmitted; on hearing the signal, the operator at the receiving station tells his assistant to turn the crank, setting the machine in motion; then setting his type at the dash, sends back signal that he is ready, and the communication is transmitted; he can leave his machine, and it will print in his absence; when the printing is finished, he tears off the strip which contains it, folds it in an envelope ready to send to any place desired. The Governor's Message has been transmitted by this instrument, and published entire in New York, two hours after its delivery in Albany.

The function of the electric current in this machine, together with the condensed air, is to preserve equal time in the printing and composing machine, that the letters in one may correspond with the other; the electrical pulsations determine the number of spaces or letters which the type wheel is permitted to advance: they must be at least twenty-five per second to prevent the printing machine from acting; the intervals of time the electric currents are allowed to flow unbroken are equal, and the number of magnetic pulsations necessary to indicate a different succession of letters are exceedingly unequal; from A to B, will require one-twenty-eighth of a revolution of the type wheel, and one magnetic pulsation; from A to A, will require an entire revolution of the type wheel and twenty-eight magnetic pulsations.

The first line operating with this instrument was completed in August, 1850, by the Boston and New York Telegraph Company, between those cities, passing through Providence, Norwich, Hartford, and New Haven; they were incorporated with a capital stock of $27,000 by the Legislature of Massachusetts, April 20, 1849; it has also been patented in England, by Jacob Brett, who is extending the lines through that Kingdom.

In reply to an inquiry of mine in regard to the number of lines employing this form of telegraph, I received the following dispatch:—

"The Boston and New York Telegraph Company using House's Printing Telegraph; about six hundred miles of wire; two wires. Stations at Boston, Mass., Providence, R. I., Springfield, Mass., Hartford, Conn., New Haven, Conn., and New York. A line being constructed to connect with the Boston line, running from Springfield, Mass., to Albany, N. York, there intersect the New York and Buffalo line, using the same instruments, extending from New York to Buffalo, a distance of five hundred and seventy miles. One wire now in operation, connecting with

Poughkeepsie, Troy, Albany, Utica, Syracuse, Lyons, Rochester, Albion, Lockport, and Buffalo; and another wire nearly completed, same distance. The same line to continue to St. Louis, Mo., connecting with Cleveland, Cincinnati, Louisville, and St. Louis; will be completed the entire distance by January, 1852, forming the longest line in the world under the direction of one company; whole length being fifteen hundred miles. The New Jersey Magnetic Telegraph Company, using House's instruments, and the first line ever put in operation, extends from Philadelphia to New York; one wire, CXXXII miles; another now being put up.

Respectfully, J. W. PHILIPS."

Subjoined is a specimen of the form of printing executed by this machine, kindly offered by the principal operator at this station, Mr. J. W. Philips, to whom, and the records of the House trial, I am indebted for most of my information.

HOUSES-PRINTING-TELEGRAPH

To be Continued.

Hints on the Principles which should regulate the Forms of Boats and Ships; derived from original Experiments. By Mr. William Bland, *of Sittingbourne, Kent.**

Continued from page 117.

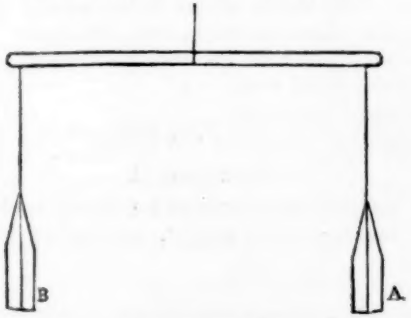
Chapter V.

The whole body of a ship comes next into consideration; and with the view of investigating the same in a perfect and lucid manner, it will be advisable to divide the subject into three parts—as "the Bows," "the Stern," and "the Middle."

Of the Form of the Bows.

The experiments which were put into practice for ascertaining the law relative to the difference of form when exposed to the action of water, are arranged severally as follows. And the diagram beneath exhibits the mode by which the testing of the speed was applied.

The Balance Rod. Scale one-sixteenth.



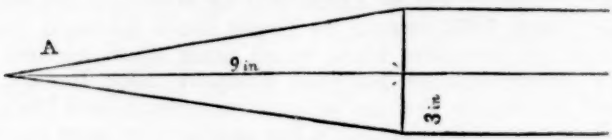
Experiment 9.

First. The form of the model selected was that of an isosceles triangle,

* From the London Architect for September, 1851.

having the perpendicular distance of the base from the apex three times the width of the base.

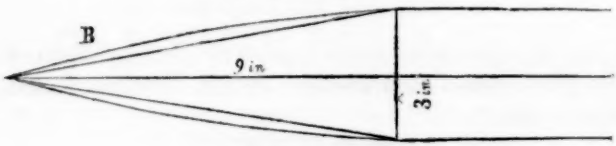
Weight 12 oz. Thickness 1½ inch.



Experiment 10.

Second. This form was an isosceles spherical triangle, of the same perpendicular length and width at the base as the preceding, but having the two sides uniting the base with the apex convex; the curve subtending at the middle of the length one-quarter of an inch beyond the straight lines uniting these two points.

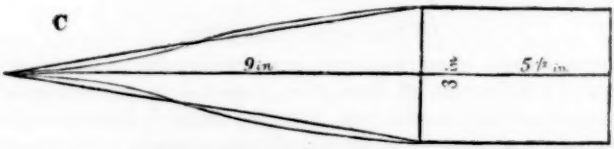
Weight and Thickness as A.



Experiment 11.

Third. The form of an isosceles triangle, with its two sides waved; and the dimensions in other respects the same as models A and B.

Weight and Thickness as B.



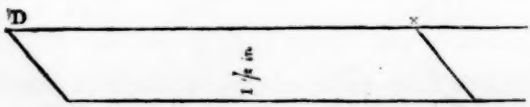
These three models of deal, A, B, C, of the same precise weight, depth, width, and length, were tested on the water against each other, by the balance-rod, and the following results were obtained:

Model B had the greatest speed,
Model A the next,
Model C the least.

But the difference between them was trifling.

Experiment 12.

The model A was then tried against the fourth model D, of the same form of bows, dimensions, and weight, but having its lower isosceles sides beveled off.

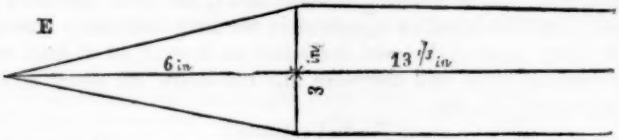


The difference of speed between these two was not perceptible.

Experiment 13.

The next test of bows was with those of less sharpness, and compared first with the sharp-modelled bow A, and then with others of less acute angles.

Weight 14¾ oz. Thickness 1½ inch.



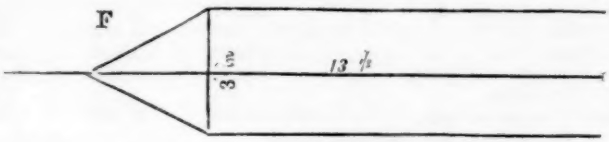
The isosceles triangle form of bows E, had its perpendicular distance from the base 6 inches; yet having the width, depth, and base precisely the same as A.

The conclusion arrived at was, that the speed of A : E : : 6½ : 5.

Experiment 14.

The speed of E was then tested with the speed of the model F, having its base and sides equilateral.

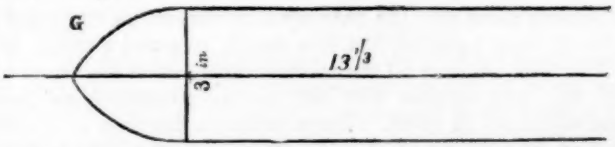
Weight and Thickness as E.



The result gave the speed in favor of E : F : : 3 : 2.

Experiment 15.

The model F was tried against G, a model having its bows a spherical equilateral triangle.

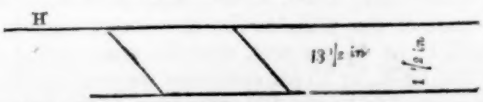


The weight of model G the same as F; the speed in favor of F was F : G : : 6 : 5½.

Experiment 16.

The last test was between the equilateral triangle bows F, and the bows H, of the same dimensions and similitude; but having its isosceles sides beveled off, the angle at the cut water being 45°.

Weight and Thickness as F.



The speed of H was to that of F : : 5 : 4.

The beveled bows of H threw the water off admirably, or rather it may

be said to ride over it, and was always dry during the experiment; whereas F shipped water continually over the bows with the least extra speed.

The conclusions obtained by the experiments in this chapter are, that the more sharp the forms of the bows the less is the resistance from water; and when a gentle curve is given to the bows, the speed is rather improved. Again, by the beveling of short bows, the speed becomes greatly improved; but this is not so apparent in the long and sharp bows. The beveled short bows rode over the water as it were, or at least was in a degree lifted up by it, and therefore did not throw the water up like the perpendicular side bows.

(To be Continued.)

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*Export of Metals from the United Kingdom.**

The Board of Trade returns afford the following detailed account of the quantities of metal of home produce and manufacture exported from the United Kingdom during the month ending the 10th of October last, as compared with the corresponding period of the two previous years:

Metals.		1849.	1850.	1851.
Iron—Pig,	tons	20,309	11,333	18,068
Bar, bolt, and rod,		38,451	44,438	47,094
Wire,		478	457	505
Cast,		1,580	1,812	1,398
Wrought of all sorts,		11,688	14,534	13,680
Steel—Unwrought,		801	1,171	1,334
Copper, in bricks and pigs,	cwts.	19,909	24,189	8,854
Sheets, nails, &c. (including mixed or yellow metal for sheathing,)		26,112	30,373	18,792
Wrought of other sorts,		1,027	491	1,495
Brass of all sorts,		2,593	3,553	2,625
Lead,	tons	2,739	2,345	2,213
Tin—Unwrought,	cwts.	5,315	4,392	2,514
Tin-plates,	value	£78,177	£88,254	£71,386

These returns show that the increased movement in the metal trade, noticed for so long a period, has this month received a rather sensible check. The total value of all the metals comprised in the above table is 797,812*l.* this year, against 893,780*l.* in the corresponding period of 1850, and 830,310*l.* in 1849. There is thus a decrease of 95,968*l.* on 1850, and of 32,498*l.* on 1849. On referring to the various items, we find the falling off to extend to copper, lead, tin, and tin-plates, but it is most evident in the first named article, the exports of copper and brass being only 137,808*l.*, against 243,218*l.* last year, and 210,626*l.* in 1849. Iron, on the other hand, has largely increased, the aggregate figures being 493,705*l.* this year, against 464,018*l.* and 446,213*l.* in the same month of the two previous years. Steel has also increased; the returns for the nine months ending with the same date, give the total exports as follows:—1851, 7,189,107*l.*; 1850, 6,869,076*l.*; 1849, 6,216,420*l.*; so that the aggregate trade of the year, so far as yet ascertained, shows an increase of 320,031*l.*, or 4½ per cent. over the same period of 1850, and an increase of 972,687*l.*, or 15 per cent. over the year before. The foreign trade in iron is proved to be steadily extending, as the demand for foreign

*From the London Mining Journal, No. 847.

railways is more sensibly felt. The iron and steel exports are 4,393,070*l.* in 1851, against 4,020,355*l.* in 1850, and 3,667,348*l.* in 1849. Copper figures for only 1,291,407*l.* against 1,429,773*l.* in 1850, and 1,414,377*l.* in the year previous. In the year's returns of tin-plates and lead there is a considerable increase, so that the falling off of the month is only a trifling reaction, but the decrease in tin is continuous. The exports of foreign and colonial produce for the month ending October 10th, are as follows:

		1849.	1850.	1851.
Copper, unwrought and part wrought,	cwts.	1045	3151	1483
Iron, in bars, unwrought,	tons	571	758	1174
Steel, unwrought,		9	23	168
Lead, pig and sheet,		742	194	298
Spelter,		424	126	205
Tin, in blocks, ingots, bars, or slabs,	cwts.	808	849	1460
Quicksilver,	lbs.	116,527	29,419	67,332

On the nine months we have a great increase in copper, which stands at 22,569 cwts., against 12,428 last year, and 12,447 in 1849. Taking this result in connexion with the diminished export of our home produce, it is evident that the foreign and colonial supplies of this metal are daily becoming of more importance, the working of the copper mines of Australia producing a sensible effect. Iron has slightly fallen off, whilst steel and tin remain at the reduced range of last year, though this last item is recovering. Spelter is steadily decreasing, the figures being only 1509 tons, against 3110 tons last year, and 3632 in 1849. The returns of imports for the month ending October 10, are:

Metals.		1849.	1850.	1851.
Copper ore and regulus,	tons	5627	4174	1805
Copper, unwrought, and part wrought,	cwts.	1015	2807	5360
Iron, in bars, unwrought,	tons	4739	5068	7146
Steel, unwrought,		102		39
Lead, pig and sheet,		1109	695	1356
Spelter,		2371	2269	1468
Tin, in blocks, ingots, bars, or slabs,	cwts.	3967	539	5704
Quicksilver,	lbs.	100,469		

In this instance also, taking the nine months' returns as the basis of comparison, there is exhibited a continuous falling off in the various descriptions of copper, and an increase in iron and steel. Lead and tin have also largely augmented, showing the increased consumption of the country. Spelter has risen to 16,204 tons, against 11,429 last year, and 8722 in 1849; and as the exports of this article are as gradually diminishing, it would appear that the free admission of this metal is bringing it into much more extensive use.

For the Journal of the Franklin Institute.

Boilers of the U. S. Steamship Fulton. By Chief Engineer, B. F. Isherwood, *U. S. Navy.*

Since writing an account of the performance of the *Fulton*, on her trial trip, I have been able to ascertain the performance of her boilers under the ordinary circumstances of sea steaming, burning the fuel with natural draft, and without forcing the fires.

The fuel used was soft anthracite, a mean between the Cumberland coal and the anthracite proper. The data is the average of 11 hours continuous steaming.

BOILERS.—PLATE I.

Two double return drop flue iron boilers, circular from end to end, placed side by side.

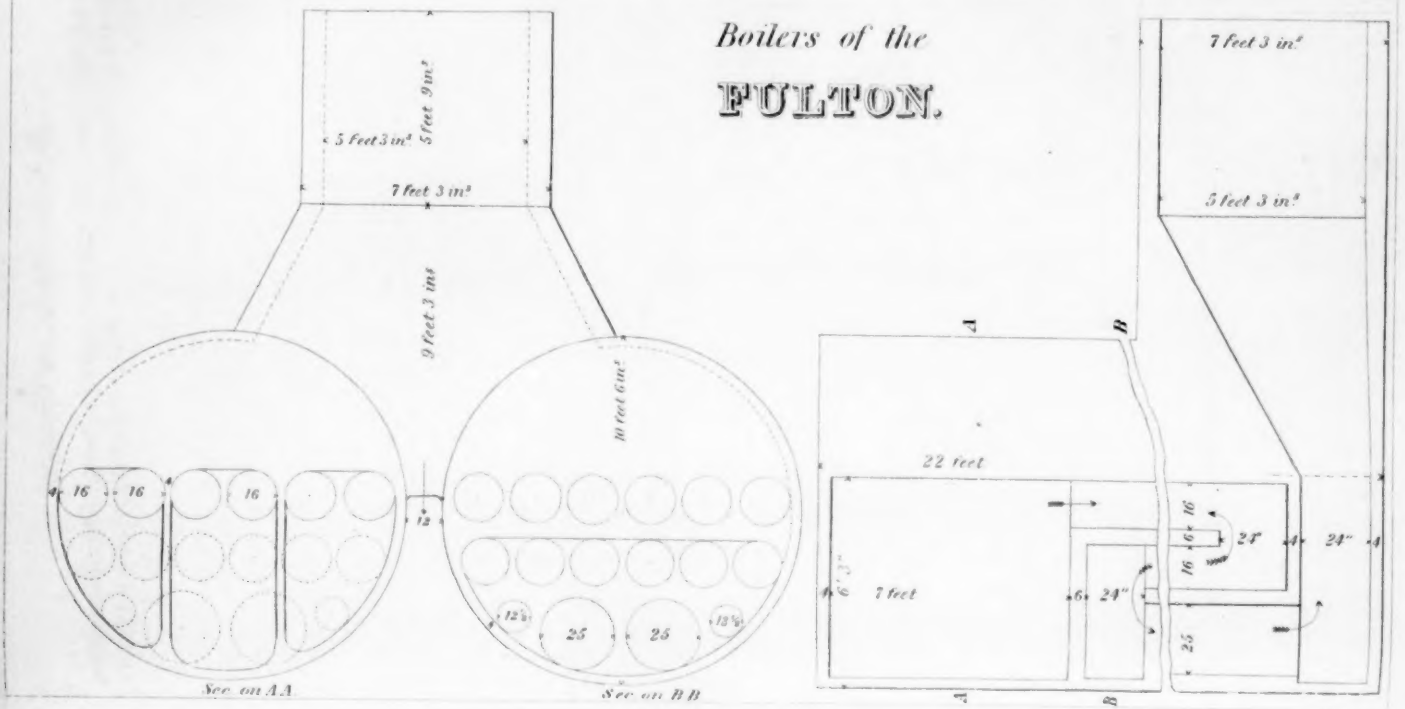
Length of each boiler,	22 feet.
Diameter,	10 feet 6 in.
Contents of circumscribing parallelopipedon of each boiler, exclusive of steam chimney,	2425·50 cu. ft.
Area of heating surface in the two boilers,	2600·00 sq. ft.
" grate " "	112·00 "
Cross area of upper and middle row of flues, each, in the 2 boilers,	16·75 "
" lower row of flues, in the two boilers,	17·40 "
" chimney,	21·65 "
Height of chimney above grate,	43·00 feet.
Pressure of steam above atmosphere in boiler per square inch,	24·00 lbs.
Initial steam pressure above atmosphere in cylinder, "	22·30 lbs.
Cutting off at, from commencement of stroke,	3·00 feet.
Number of double strokes of piston per minute,	16.
Consumption of anthracite coal per hour with natural draft,	1342·00 lbs.
Capacity of steam room in boiler and steam pipe,	1210·00 cu. ft.

PROPORTIONS.

Proportion of heating to grate surface,	23·214 to 1·000	
" grate surface to cross area of upper and middle row of flues, each,	6.687	"
" " lower row of flues,	6.437	"
" " chimney,	5·173	"
" heating surface to cross area of upper and middle row of flues, each,	155·224	"
" " lower row of flues,	149·425	"
" " chimney,	120·092	"
" " per cubic foot of space disp. of piston,	18·453	sq. feet.
" " " per double stroke of pist. per min.	1·153	"
" grate, "	0·050	"
" " " per cu. ft. of space disp. of piston,	0·795	"
Cubic feet of steam room per cubic foot of space displacement of piston,	8·587	
Consumption of anthracite coal with natural draft per square foot of grate surface per hour,	12·000	lbs.
" heating "	0·516	"
Sea water evaporated by one pound of anthracite coal per hour,	5·552	"
" " one sq. ft. of heating surface per hour,	2·865	"
Weight of boilers, exclusive of chimney & grates, 111,356 lbs.		
" chimney, jacket, and chains, 7,400 "		
" grates, 5,239 "		
	123,995	"
" sea water in boilers,	82,300	"
Total weight of boilers and water,	206,295	"

In the above calculation of the amount of sea water evaporated per pound of coal, there is nothing allowed for blowing off, as the density of the water is recorded from $\frac{1}{32}$ to $\frac{17.5}{32}$ progressively. There being evaporated per hour 7112·67 pounds of sea water, there would be required over 11 hours steaming to make the density $\frac{2}{32}$, supposing the density at starting to be $\frac{1}{32}$. There has, however, been included in the calculation the quantity of steam (3·094 cubic feet) required to fill the spaces between valves, in nozzles, and clearance of cylinder.

Boilers of the FULTON.



By driving the blowers, the boilers can be made to fill the cylinder to half stroke with steam of 30 pounds per square inch cylinder pressure above the atmosphere, giving the piston a proportionally increased number of strokes. When this is done, however, *foaming* or *priming* takes place.

It may be of advantage to compare the results obtained from the Fulton's boilers with those obtained from the experimental boiler at the Washington Navy Yard, of nearly the same proportions, used by Prof. Walter R. Johnson, in his investigations on coals. The proportions compare as follows, viz:

	Johnson's Boiler.	Fulton's Boiler.
Proportion of heating to grate surface,	26·000 to 1·000	23,214 to 1·000
" grate surface to least calorimeter,	6·449 "	6·687 "
Height of chimney above grate,	58·000 feet.	43·000 feet.
Pounds of anthracite coal burned per sq. foot of grate per hour with natural draft,	6·130.	12·000.
Pounds of fresh water evaporated per hour per pound of anthracite, from a temperature of 100° F.	8·900.	5·713.
Pounds of fresh water evaporated per hour per square foot of heating surface, from a temperature of 100° F.	2·060.	2·960.

The above figures show pretty conclusively the advantages to be derived from a slow combustion, in giving time not only for the atmospheric air to become so well mixed with the constituents of the fuel as to completely oxidize them, but also in giving time for the caloric to enter the water, or be taken up by it.

In the above two boilers, we find that with nearly equal proportions of heating to grate surface, nearly double the quantity of fuel is burned per square foot of grate per hour in the Fulton's boiler, while the quantity of water evaporated per square foot of heating surface per hour is only 43·7 per cent. *more;* while the economical evaporation is 35·8 *less*. Now, inasmuch as in one case there is burned double the quantity of fuel per unit of grate per unit of time, than in the other, it is obvious that if the two combustions were equally complete, double the amount of caloric would be evolved in the one case over the other, and if it were proportionally absorbed by the heating surface, double the quantity of water per unit of heating surface per unit of time would be evaporated in the one case over the other; but we find this difference to be practically only 43·7 per cent. more; consequently the caloric, if evolved, could not have been taken up by the heating surface, but must have passed off up the chimney, and by this very passing off up the chimney, produced the increased draft necessary to burn a double amount of fuel.

The potential evaporation of the two boilers per same units may be compared as (6·43 × 8·9) 57·227 to (5·713 × 12) 68·556, or as 1·000 to 1·198; consequently if the grate and heating surfaces of the Fulton's boilers had been one-fifth greater, or 134·4 and 3120 square feet, instead of 112 and 2600 square feet, and half the quantity of fuel burned per unit of grate per unit of time, the same steam power could have been obtained with 35·8 per cent. *less* fuel; making the chimnies of course of equal heights, the draft due to the greater height in Johnson's chimney being one-sixth more than in the Fulton's.

It is not, however, always practicable in a steamship to obtain space for a larger boiler, and economy of fuel must frequently be sacrificed to other considerations. The economical evaporation of the Fulton's boilers is about equal to that of the general average of marine boilers.

In making the comparison *absolutely*, it must be borne in mind, that in the Fulton's boilers there were wastes by leakage of steam through the valves, and by foaming, *not included* in the calculation of their evaporation, while the calculation of the evaporation in Johnson's boilers was made from measurement of the actual amount of water put in them; of course, the calculation was *inclusive* of all losses.

For the Journal of the Franklin Institute.

Reply to the Remarks of J. V. Merrick, Esq., on Screw Propellers. By J. W. Nystrom.

The critique of Mr. J. V. Merrick, in the January number of the Journal, was not seen by me until some time in February. With the greatest respect for Mr. M., it is the principles set forth in his article, and the defence of a theory *not unsupported* by proof and probability, that has called forth the present article.

First, as to the slip of the San Jacinto; I will not contradict the assertions made by reliable witnesses, as I was not there.

Mr. Merrick suggests, first, "a heavy weather at sea, &c." We could as well say a good fair wind, which then would decrease the slip; these are results of circumstances. The assertion that there would be "no difficulty in giving the propeller 50 revolutions," was misunderstood. If the readers of the Journal will examine my statements and formula 11, page 330, last vol., they will see it never entered my thoughts to say *a paddle wheel which makes* 31 *revolutions can, with no difficulty, make* 50. But when the power of the steam engine, and the diameter, pitch, and *slip* of the propeller are given, *from them*, I said there would be no difficulty in giving the propeller 50 revolutions per minute, and the words, "the number of revolutions can *not* be increased ad libitum," prove that my statements were misunderstood. As to the slip being a measure of loss of effect, I supposed the propeller to have no slip, in order to prove that the slip is not a measure of loss of effect; this, I see, has not been fairly understood, and will endeavor to make it plainer. If we say the slip to be determined of 100, and 0—and *in* and *between* those two points, examine the slip, we will find that when the slip is 0, there exists no "recession of the fulcrum against the propeller blades," and the propeller does not act to propel the vessel, but merely runs with it, and there exists no loss of effect. On the other hand, we suppose the slip to be 100, (that is, when the vessel stands stationary, and the propeller is running,) and the slip is a measure of loss of effect as described by Mr. Isherwood, then the slip should take away *all the effect* from the steam engine, and *not allow* any for the friction and working the pumps; still the steam engine runs.

Again, let us take a few steps back, and suppose the slip to be 80 per cent., which is often the case with tow boats; then, if the loss of effect is

80 per cent., there is only twenty per cent. left, which is nothing more than what is required for the friction and working the pumps, consequently nothing left as useful effect for towing; still the vessel is running, and in this age of common sense, we do not believe that witchcraft tows the vessel; take the same tow boat to tow a smaller vessel, which causes a slip of only 50 per cent.; the friction and working the pumps being the same, 20 per cent., then there remains 30 per cent., as useful effect for towing. We see now, that if slip is a measure of loss of effect, it requires more power to propel a small vessel, and no power to propel the largest vessel.

I am obliged to Mr. Merrick, for reminding me what slip is, but would in turn, remind him, that there is as much difference between the slip of a locomotive wheel, and slip of a propeller, as there is between the sleepers and water. I was careful to state, in the article referred to, "*slip in the water.*" The locomotive runs on sleepers; therefore, if Mr. M. will try the experiment with a locomotive in water, he will find it will run as well without the wheels.

In reminding me what slip is, Mr. Merrick says: "slip is a loss of space passed over in a given time; hence a loss of velocity; and therefore, that it is what is commonly called, "loss of effect," or more correctly speaking, loss of useful effect."

Am I so greatly mistaken? or is it necessary, in this Journal, to go back to the school boy's task, and explain the difference between *velocity* and *effect?*

Effect is the *product* of *resistance* and *velocity.* But for screw propellers, this velocity is nothing but the slip of the propeller, or more correctly, the velocity of the pitch, multiplied by the slip. If we again suppose there is no slip, the velocity of the resistance will also be nought; but when we suppose the slip to be the unity, the velocity of the resistance will be equal to the velocity of the pitch. If we say the velocity of the pitch to be =1, then the velocity of the resistance will be equal to the slip, and effect equal to the product of the slip and resistance.

When a plane moves in water, perpendicular to the direction of its motion, the *resistance* will be in proportion *nearly as the surface of the plane and square of its velocity;* therefore, effect will be equal to the cube of the velocity multiplied by the surface of the plane; and for screw propellers, the useful effect which propels the vessel, will be measured by the *cube of the slip multiplied by the area of the propeller.*

Expressed in a formula, the effect delivered from the steam engine should be

$$\text{Effect} = A\,S^3$$

which in full, reacts to propel the vessel, with the same effect; or,

$$\text{Effect} = p\,v.$$

See further for explanation of the letters.

If there exists any loss of effect by slip, I *cannot* find where it will be. From observations on propellers, we will find that propellers with more pitch and slip, employ the effect better than propellers with less pitch and slip. See the remarks of Lieut. Gordon, of the R. N., on screw propellers, page 62, last vol. I do not mean to say that slip in itself is any gain of effect, but the gain consists in this, that propellers, with more

pitch and slip, do not require a proportionate power from the steam engine, to give the propellers the same velocity, as propellers with less pitch and slip.

Although there is a limit for the proportions of pitch and diameter, which may be about the former three times the latter.

For the present, we will make a rough sketch in reference to the slip on the *San Jacinto*; the letters will denote,

p=mean thrust given by the dynamometer in pounds; see page 344 last volume.

v=velocity of the vessel in feet per second.

S=velocity of the slip in feet per second.

s=slip of the propeller in a decimal fraction.

r=resistance of the water to the propeller in pounds.

The mechanical effect executed on both sides of the propeller should be equal; then we have

$$p.\ v = r.\ \mathrm{S}.$$

$$\text{and } r = \frac{p.\ v.}{\mathrm{S}}$$

$$\text{but } v = 1 - s$$

$$\text{then we obtain } r = \frac{p\,(1-s)}{s} = \frac{p}{s} - p \quad . \quad . \quad . \quad (1.)$$

By reference to Haswell's Pocket Book, on page 229, it says:

"1. That the resistance is nearly as the surface, the resistance increasing but a very little above that proportion in the greater surfaces.

"2. The resistance to the same surface is nearly as the square of the velocity, but gradually increasing more and more above that proportion, as the velocity increases."

At the bottom of page 231, in the table, we find that one square foot having a velocity of 10 feet per second, will sustain a resistance of 112 pounds. From these we obtain the following analogy:

$$10^2 : 112 = \mathrm{A}\,\mathrm{S}^2 : r$$

$$\text{and } r = \frac{112\,\mathrm{A}\,\mathrm{S}^2}{100} \quad . \quad . \quad . \quad . \quad (2.)$$

If we, from these formulæ, 1 and 2, calculate the resistance, we should obtain two equal results. A=165 square feet, area of the propeller.

$$\mathrm{S} = \frac{968 \times 26}{60 \times 74} = 5{\cdot}66 \text{ feet per second.}$$

$$p = 12{,}815 \text{ pounds.}$$

Formula 1. $$r = \frac{12815}{0{\cdot}26} - 12{,}815 = 36{,}273 \text{ pounds.}$$

Formula 2. $$r = \frac{112 \times 165 \times 5{\cdot}66^2}{100} = 5900 \text{ pounds.}$$

These two results, which should be equal, *one* is more than *six* times the other. Both of them cannot be right. If we add them together, and divide the sum by two, the mean resistance will be 21,086 pounds. Perhaps that will come nearer the proper one.

In the last volume, on page 403, the formulæ gives the slip to be nearly 38 per cent.; if we, in the same manner as above, calculate the resistance from the formulæ 1 and 2,

$$s=0{\cdot}38.$$

$$S=\frac{968\times 38}{60\times 62}=9{\cdot}9 \text{ feet per second.}$$

Formula 1. $$r=\frac{12815}{0{\cdot}38}-12815=20{,}900 \text{ pounds.}$$

Formula 2. $$r=\frac{112\times 165\times 9{\cdot}9^2}{100}=18{,}100 \quad \text{“}$$

Mean resistance, $=19{,}500$ “

If the slip has been a little over 39 per cent., then it has corresponded with the table in Haswell's Pocket Book, which experiments were made with a plane of only one square foot; but we doubt it will differ so much as in the first instance, with 26 per cent. slip. We leave this to propeller builders for further investigation.

For the Journal of the Franklin Institute.

Performance of the U. S. Screw Steamship San Jacinto, on an Experimental Trip from New York to Norfolk. By Chief Engineer B. F. Isherwood, *U. S. Navy.*

On the 1st January, 1852, the *San Jacinto* left the Navy Yard at Brooklyn, for Norfolk. Her draft of water was 16 feet 10 inches forward, and 17 feet 2 inches aft; mean draft 17 feet. During her passage down the Bay, there was a dead calm and slack tide, the flags at Fort Hamilton drooping from their staves. By observations taken on board the U. S. Steamer *Fulton*, the *San Jacinto* was precisely two hours in going from the Navy Yard to the South West Spit; distance per Coast Survey, 18½ miles, or 9¼ statute miles per hour. By observation on board the ship, however, and by log, she went this distance at the rate of 8 knots of 6140 feet (made that length in this particular case) per hour, or 9·3 statute miles. I shall take the latter speed as most probably correct, being obtained by observation on board; the discrepancy is, however, very small, amounting to only ·05 of a statute mile per hour. The reports of speed were made from the different vessels without communication. The number of revolutions of the screw per minute was 25¼; steam pressure in boiler per square inch above atmosphere, 10 pounds, cut off at half stroke; vacuum in condenser, 24 inches of mercury; throttle three-fourths open; the engines working irregularly, passing one centre very slowly. *Slip of the screw, 23·71 per cent.*

After passing outside of Sandy Hook, the mean of four hours steaming was as follows, viz: Speed of vessel, 7 knots per hour; revolutions of the screw per minute, 22¼; steam pressure in boiler above atmosphere, per square inch, 10 pounds; cut off at half stroke; vacuum in condenser,

24¾ inches of mercury; throttle three-fourths open; *very* light head wind, and sea perfectly smooth. *Slip of the screw*, 24·25 *per cent.*

For the next four hours, in continuation, with a light favorable wind, fore and main topsails set, sea smooth, the vessel made 8½ knots per hour; revolutions of the screw, 23 per minute; steam pressure in boiler above atmosphere, per square inch, 10 pounds; cut off at half stroke; vacuum in condenser, 25 inches of mercury; throttle five-eighths open. *Slip of the screw*, 11·02 *per cent.*

The eccentric of the port engine now broke, and it was not until January 3d that the damage was repaired, and the engines got in operation. At starting again, against a very strong wind and head sea, no sail set, the speed of the vessel was 5¼ knots per hour; revolutions of the screw, 25 per minute; steam pressure in boiler, 10 pounds per square inch above atmosphere; cut off at one-half stroke; vacuum in condenser, 24 inches of mercury; throttle wide. *Slip of the screw*, 49·43 *per cent.*

Close reefed fore and main topsails being now set, produced no sensible change either in the speed of the vessel or revolutions of the screw.

The wind now (Jan. 5) increased to a very heavy gale, directly ahead, accompanied by a very heavy head sea; no sail set, and vessel pitching and rolling with great violence. Speed, (mean of 12 hours,) 3·52 knots per hour; revolutions of the screw, 22⅝ per minute; steam pressure in boiler per square inch, above atmosphere, 10 pounds; cut off at one-half stroke; vacuum in condenser, 24 inches of mercury; throttle three-fourths open. *Slip of the screw*, 62·88 *per cent.*

On January 6, with fresh gales abeam and heavy sea, close reefed fore and main topsails set, and ship rolling heavily, the vessel made 4½ knots per hour; revolutions of the screw, 19 per minute; steam pressure in boiler above atmosphere, 5 pounds per square inch; vacuum in condenser, 24 inches of mercury; throttle one-half open. *Slip of the screw*, 42·97 *per cent.*

On January 7, the piston (made of brass) of the port engine broke. This engine was then disconnected, and the vessel worked with the starboard engine alone.

On January 8, there being no wind, and the sea smooth, the vessel made with the one engine alone, 7½ knots per hour; revolutions of the screw, 23 per minute; steam pressure in boiler per square inch, 11 pounds; cut off at one-half stroke; vacuum in condenser, 25 inches of mercury; throttle three-fourths open. *Slip of screw*, 21·48 *per cent.*

The performance of the vessel in heavy weather, "laying to," was as follows, viz: In a heavy head sea, and heavy gales and squalls ahead, with the engines stopped and screw dragging, vessel pitching and rolling violently, close reefed fore and main topsail set, and fore storm staysail; speed, 2½ knots per hour. Under these circumstances, it was difficult to tack or wear the ship, the latter operation requiring 30 minutes. The best sailing ship of her size, under these circumstances of weather, speed, and sail, could have done no better.

With moderate breezes and heavy sea, the vessel made with the above sail, 5½ knots per hour; engines stopped; screw uncoupled, and revolving by its friction on the water.

On arriving at Norfolk, January 8, the vessel's draft was 16 feet forward,

and 16 feet 1 inch aft; mean, 16 feet ½ inch, or 11½ inches less than at starting.

By referring to the previous account of the trial trip of the *San Jacinto*, it will be found that the slip is given on that occasion at 26·27 per cent., with the vessel at the mean draft of 15 feet 8 inches; while on the present passage down New York Bay, the slip was 23·71 per cent., with a mean draft of 17 feet. The stern drafts in the two cases were 15 feet 9 inches, and 17 feet 10 inches, or there was a difference of 2 feet 1 inch in the depth of water on which the screw acted. In the report on the trial trip, I thought the speed of the vessel a little underrated, and that the effect of the "strong wind on the port bow" operated a greater reduction than "one mile per hour." The reporters preferred to err a little on the safe side, rather than risk error in giving the vessel too much speed. At the close of the present trip to Norfolk, the slip was 21·48 per cent., with a mean draft of vessel of 16 feet ½ inch. Taking the mean of the three slips, we have a slip of 23·8 per cent. It will be observed that the Board which fixed the proportions of the screw of the *San Jacinto*, estimated its slip at 22 per cent., a much nearer calculation than that of Mr. Nystrom, who makes the slip 37·7 per cent., and undertakes, in a late number of the *Journal*, to correct their observations of the speed of the vessel, and revolutions of the screw, which determine the slip, by some empirical formulæ invented by himself. Now an empirical formula of any kind will only give correct results so long as *all* the conditions, intrinsic and accidental, of the case on which it was founded, exist *exactly the same* in the case to which it is applied; and it is rather difficult to conceive how formulæ founded on the performance of a few Philadelphia little tug steamers, fitted with Loper's propellers, could apply to a steamship of the size and fine model of the *San Jacinto*, propelled with a screw of the most effective form.

The small slip of the screw of the *San Jacinto*, comparatively to its surface and the resistance of the vessel, is the best illustration of the advantage of a rapidly increasing pitch.

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*Commercial Statistics of Great Britain.**

The information collected by Mr. Braithwaite Poole for his valuable work, certainly exhibits most surprising results. Pitt and Canning stated the yearly production of our agricultural and manufacturing pursuits at an amount equal to the national debt; but nobody knew how they made it out. The summary of these statistics, however, prove that our great statesmen were right; and the comparisons are highly interesting.

Mr. Poole shows that the Railways have cost 240,000,000*l.*; the Canals, 26,000,000*l.*; and the Docks, 30,000,000*l.*

Our Mercantile Marine consists of 35,000 vessels, 4,300,000 tons, with 240,000 men; and one vessel is lost on an average every tide.

Our Navy consists of 585 vessels, 570,000 tons, and 48,000 men. Yachts 520, and 23,000 tons.

The ancient Britons knew only six primitive ores, from which metals

* From the London Mining Journal, No. 847.

were produced; whereas the present scientific generation use fifty. The aggregate yield of minerals in this country is equivalant in value to about 25,000,000*l.* annually.

The Agricultural produce, of milk, meat, eggs, butter, and cheese, 3,000,000 tons, and 50,000,000*l.*

The ale, wine, and spirits consumed annually exceed 3,300,000 tons, and 54,000,000*l.*; whilst sugar, tea, and coffee scarcely reach 450,000 tons, and 27,000,000*l.*

Our Fisheries net 6,000,000*l.* annually.

In Manufactures, the cotton, woolen, linen, and silk altogether amount to 420,000 tons, and 95,000,000*l.*; whilst hardwares exhibit 360,000 tons, and 20,000,000*l.*; in addition to which 1250 tons of pins and needles are made yearly, worth 1,100,000*l.*

Earthenware, 160,000 tons, 3,500,000*l.*; glass, 58,000 tons, 1,680,000*l.*

The Gazette shows an average of four bankrupts daily throughout England and Wales.

In fact, the whole book is full of the best information that could be collected, and should be possessed by all interested in scientific, literary, or commercial pursuits.

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*Trial and Description of Stevens' Patent Fan Paddle.**

On Saturday, December 6, a trial was made of the efficiency of this paddle, which is the invention of Mr. Lee Stevens. It consists of fixed oblique floats on the circumference of the wheel, and diminishing in surface towards the centre, like a lady's fan, which floats or segments, as the wheel revolves, press alternately right and left against the water, and by their oblique action spread the water as it were towards each side, abaft the paddle, and thus materially diminish the back water as compared with the ordinary paddle, and also the vibration on board the boat very considerably. The operation of the paddle is uniformly the same, whether the motion be ahead or astern. The trial above referred to was made entirely at the expense of the Iron Steamboat Company, who had one of their boats, namely, the *Twilight*, fitted with Mr. Stevens' fan floats in a modified form in wood, instead of iron. The inventor expects that when his ideas are carried out by the construction of the fan paddle wheels in iron, as originally intended, their advantage will be still more apparent.

Two vessels belonging to the Company, the *Bridegroom* and the *Twilight*, being twin boats of equal power, having oscillating engines of 12 horse power each, started together from Cadogan-pier with the tide, at a quarter to 2 o'clock, the paddles making 44 revolutions per minute. On reaching Vauxhall Bridge, the *Twilight* was some distance ahead, and on passing Waterloo Bridge, she was still further ahead, having passed it 40 seconds before the *Bridegroom*. On the *Twilight* reaching London Bridge, at five minutes past 2 o'clock, the *Bridegroom* was about three-fourths of the distance between the two bridges behind her. The revolutions of the paddles were at the rate of 44 per minute. On returning up the river against the tide, at 10 minutes past 2 o'clock, the *Bridegroom* was given

* From the London Railway Magazine, No. 653.

the side of the river, which was, of course, an advantage, the *Twilight* being all the time out in the river. The paddles revolved at the rate of 40 per minute, and the boats moved at the same speed until they passed Westminster Bridge; but on passing Vauxhall Bridge, the *Twilight* got considerably ahead, and on passing Chelsea Hospital, at 39 minutes past 2 o'clock, she was about 300 yards ahead of the *Bridegroom*, and the paddles were then making 44 revolutions per minute, until she arrived at Cadogan-pier. It was stated that the number of revolutions of the paddle wheels on board the *Bridegroom* averaged 44½ per minute, and on board the *Twilight* 42 per minute. The vibration in the *Twilight* was scarcely perceptible in the run both up and down the river, which, together with the steadiness of motion produced by the fan paddles, the effect was very agreeable.

It is understood that the fan paddle is to be applied to one of the large sea-going steamers, with a view to increase her speed, and to get rid of the vibration now caused by the ordinary paddles.

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*To Increase the Illuminating Power of Gas.**

In one of your late numbers, you allude to a recent patent for improvements in the manufacture of gas, the object of which is to render the gases resulting from the decomposition of water suitable for lighting purposes, by passing them over cannel coal in the process of distillation. I witnessed some experiments of this nature with the gases obtained from wood in the manufacture of pyroligneous acid, and have myself, for some time past, been making a series, using several descriptions of slightly illuminating gas, but principally those given out by peat and the lowest quality of coals, and the results are highly interesting. I find that a certain volume of such gas when passed through a heated retort containing Lancashire cannel coal, becomes of much greater illuminating power than the same volume of such gas mechanically mixed in a gasholder with the gas given out by the cannel; indeed, some of my experiments show this increase to be at least 50 per cent. when our common coal gas is so treated, as 10,000 feet of it may be passed through the retorts containing a ton of Lancashire cannel in the process of distillation, and the result will be 20,000 feet of gas equal in quality to that given out by the cannel alone, and it incurs no perceptible deterioration by being retained in a gasholder for several days.—C. C.

The Collodion Process in Photography. By Fred. Scott Archer.†

I am anxious to communicate to those engaged in the Collodion process in Photography an improvement in the manipulation which I believe will be found to facilitate the process considerably. It is, the use of the upright glass bath for the nitrate of silver solution:—and I will endeavor, in as few words as possible, to explain my mode of using it. The bath is about three parts filled with a solution of nitrate of silver of the usual

* From the London Builder, No. 461.

† From the London Athenæum, November, 1851.

strength; and the prepared glass (as soon as the film of collodion has set) is plunged into it. The whole is then placed in its proper position in the camera, the focus having been previously obtained; and the light is thus allowed to act on the prepared film whilst in the bath of nitrate of silver. By this means great cleanliness is preserved in the manipulation, and very delicate pictures are obtained. I have used this bath during the whole of the summer and autumn; and several friends, at my suggestion, have adopted it with great success. The bath is made of two pieces of the best plate glass, connected together at the sides and bottom, and gradually tapering downwards so as to form a narrow wedge-shaped bath, the top being about three-eighths of an inch wide, and the bottom one-eighth. This bath is cemented into a wooden frame, having a closely fitting lid to prevent all dust falling into the solution.

13, *Tavistock Street, Covent Garden.*

A Simple Process for Precipitating the Cotton contained in Collodion. By Thomas Cattell, M. D., *M. R. C. S. Eng. &c., Braunston.**

A short time since, I ascertained that on mixing bisulphuret of carbon with collodion, an immediate precipitation or separation of the cotton takes place, leaving a limpid fluid consisting only of the solvent and precipitant.

The cotton presents the same fibrous appearance as though it had not been in a previous state of solution, and as gun-cotton would do if simply immersed in water. When dried (as much moisture as possible being first pressed out between folds of linen or bibulous paper) it cannot be distinguished from the dried pulp of the paper-maker.

This singular reaction of the bisulphuret on the collodion, would lead to the supposition that the gun-cotton performs the part of a base to the oxyde of ethyl, (ether,) for this substance is at once deprived of the peculiar properties which it possessed previous to solution.

It may serve also to explain more clearly the chemical composition of gun-cotton, or lignine, as acted on by nitric or nitrico-sulphuric acid.

Gutta Percha in Photography.†

At the meeting of the Photographic Club on Saturday last, Mr. Fry exhibited some charming pictures on glass, obtained by a combination of gutta percha and collodion. To the ordinary collodion—gun-cotton dissolved in ether—a small quantity of gutta percha is added, which readily dissolves. This is employed with the ordinary materials for the processes on glass,—the picture being developed by pyro-gallic acid. The extraordinary sensibility of this preparation may be inferred from the fact, that a positive copy from a glass negative has been obtained in five seconds by gas-light. The film formed on glass is far more adherent than the ordinary collodion or albumen:—we may, therefore, expect many valuable results from Mr. Fry's discovery.

*From the London Lancet for February, 1852.

† From the London Athenæum, December, 1851.

Snow Phenomena. By W. Gladstone.*

It may interest some of your readers to see the following illustration of the remarkable fall of snow mentioned by Mr. Birt in the *Athenæum* of November the 22d. It occurs in a pamphlet on Meteorology by Prof. Dove, of Berlin,—in relation to the formation of clouds of snow over plains which are situated at a distance from the cooling summits of mountains. He says, that an amateur once gathered together a large assembly in the concert hall of a northern residence. It was one of those icy, star-bright nights which are so aptly called "iron nights" in Sweden. In the room, however, there was a fearful crowd; and the heat was so great that several ladies fainted in consequence. An officer who was present sought to end this distressing state of things by attempting to open a window,—but this was impossible, so hard was it frozen to the sill. Like a second Alexander, he cut the Gordian knot by breaking a pane of glass:—and now, what happened? It *snowed* in the room! It is needless to add any comment on this, as the phenomenon explains itself.

The Planing of Iron and Casting of Glass.†

Messrs. Hawks and Crawshay, of the Gateshead Iron works, have just completed, for Messrs. R. W. Swinburne and Co., plate-glass manufacturers, South Shields, a huge plate of planed cast iron, to be used for the casting of glass. It is, we believe, the largest and heaviest plate of iron that was ever planed. Its dimensions are—length, 18 ft. 4 in.; breadth, 10 ft. 10 in.; depth, 7¼ in.; and its weight is 26 tons. Mr. Hosking, Messrs. Hawks and Crawshay's engineer, constructed a planing machine for the express purpose of executing the work; and it has the peculiarity —very dangerous in a joke or an argument, but of great value in a planing machine—of "cutting both ways." A smooth surface and a dead level have been obtained—great merits in a plate for glass casting; for the more perfect the level, the less the labor that is required, and the danger that is incurred, in communicating an even and polished surface to the glass. A smaller plate, weighing 20 tons, (also intended for Messrs. Swinburne's works,) will shortly be placed in the machine.—*Gateshead Observer.*

Cornish Engines.‡

The number of Pumping Engines reported for—

September, is 21; consumption of coal, 1512 tons; water raised, 13,000,000 tons, 10 fathoms high. The average duty of the whole is, therefore, 50,000,000 lbs., lifted one foot high, by the consumption of 94 lbs. of coal.

October, is 20; consumption of coal 1960 tons; water raised, 16,000,000 tons, 10 fathoms high. Average duty, 49,000,000 lbs., lifted one foot high, by 94 lbs. of coal.

November, is 21; consumption of coal, 1525 tons; water raised, 13,000,000 tons, 10 fathoms high. Average duty, 49,000,000 lbs., by 94 lbs. coal.—*Lean's Engine Reporter.*

* From the London Athenæum, December, 1851.

† From the London Mining Register, for December, 1851.

‡ From Herepath's Railway Journal.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, February 19, 1852.

S. V. Merrick, President, in the chair.
John F. Frazer, Treasurer.
Isaac B. Garrigues, Recording Secretary,
The minutes of the last meeting were read and approved.

A communication from Lieut. W. F. Maury, of the Washington Observatory, inviting the co-operation of the Institute on the subject of meteorological observations, was read, and referred to the Committee on Meteorology.

Donations were received from The Royal Astronomical Society, and Chas. T. Beke, Ph. D., London; Hon. James Cooper, U. S. Senate; A. C. Jones, Esq., New Orleans, La.; The Mercantile Library Association, Cincinnati, Ohio; The Maryland Institute for the Promotion of the Mechanic Arts, Baltimore, Md.; The New England Association of Railway Superintendents; T. H. Forsyth, Esq., Penn. Legislature; Lieut. H. S. Stellwagen, U. S. Navy; and Messrs. Theo. Code, John F. Frazer, Tyndale & Mitchell, John C. Trautwine, Oran Colton, and Frederick Fairthorne, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments in the month of January.

The Board of Managers and Standing Committees reported their minutes.

The Committee on the School of Design for Women presented their first Annual Report. On motion, 1000 copies were ordered to be printed for distribution under the authority of that committee.

To the Board of Managers of the Franklin Institute:

The Standing Committee on the School of Design for Women, present their first Annual Report. The establishment of such a branch in the Institute, although entirely cognate to its objects, was undoubtedly a novel and somewhat uncertain undertaking. The nucleus of the School had, however, been formed in an effort made by Mrs. Sarah Peter to enlarge the sphere of female occupation, and the results obtained by the limited means she could command, were so far successful as to warrant an appeal to the Institute to establish, and to the public to endow and support, such an institution.

That appeal was made, and cordially answered on the part of the Institute, and the subscriptions in aid of the School at length reached a sufficient amount to warrant the Committee in opening the School. This was done on the 3d of December, 1850, although the endowment and subscriptions had not reached the sum originally fixed upon as requisite for success. The Committee determined to make the experiment, and assumed the responsibility individually, of arranging its affairs so that it might be continued in operation for at least one year. A suite of rooms in the large building, No. 72 Walnut St., belonging to the American Fire Insurance Company, was rented, and plainly but comfortably furnished. Supplies of a few models, designs, and other elementary matters, were

procured. Mrs. Anne Hill, well known to our citizens as one of the most accomplished instructors in drawing, was elected Principal of the School, and Mr. Charles N. Parmalee engaged as an instructor in Wood Engraving. In a few weeks the School was well filled with pupils, and a rapid and steady progress has crowned the labors of the teachers. Arrangements were made for the reception of pay pupils, and the fee graduated according to the ability of the applicant to pay, but in no case did the charge exceed five dollars per quarter. The most liberal foundation was established for the admission of those whose circumstances did not admit of any return from them for the instruction given. These admissions have been regulated with such scrupulous delicacy and care of the feelings of the applicants, by the ladies of the Committee, that free pupils are known only to them and to the Principal of the School.

Such of the pupils of Mrs. Peter's school as desired to continue, were admitted into our school, and the one established by that lady was then closed. The progress of many of those under our charge was soon sufficient to justify the opening of an industrial department, in which the knowledge imparted in the School might be practically applied. A temporary engagement of Mr. Fillot, as an instructor in the applications of the art of design, was made, and some designs for calicoes, paper hangings, oil cloths, and carpeting produced, evincing considerable skill and taste. After this preliminary trial, Mr. Fillot's connexion with the School ceased, and an arrangement was made with Mr. Thomas W. Braidwood to take charge of the industrial department. The services of this gentleman would have been obtained at the opening of the department, but for other occupations of his, which then precluded him from giving a sufficient portion of his time to our pupils. Since the close of the summer vacation, the School may be said to have received its permanent organization, and to consist of three departments.

First, Drawing, from its elementary principles, through the course of copies from prepared studies, to original compositions, and the applications of coloring, and shading by crayons and pencils, so as to produce complete pictures.

This department is specially under the charge of Mrs. Hill, the Principal of the School, and now contains thirty-two pupils.

Second, The Industrial Department, in which the applications of drawing, shading, and coloring, to the art of design, are taught. In this department, original sketches for designs in calico printing, paper hangings, oil cloths, carpets, furniture, &c., are prepared and offered for sale. Applications are also received from manufacturers and others for the preparation of designs from sketches or ideas furnished by such applicants, so that particular branches of trade, or special tastes, may be consulted with the best promise of advantage or success. Designs and patterns prepared in the School are secured under the copyright law of the United States, which, to the extent that the law gives any security, will protect those who purchase designs from the School in the entire property in such designs, and tend to avoid piracy of the patterns by others. The pupils in this department evince much taste and skill, and all that is now wanting to give it activity and entire success, is a full supply of orders

from our extensive manufactories, which will stimulate the talents of our pupils to the production of original designs, or combinations of existing patterns, equalling any that may come from foreign countries.

This department, as before stated, is now under the charge of Mr. Thomas W. Braidwood, and contains sixteen pupils.

Third, The Department of Wood Engraving and Lithography, with six pupils. In these branches the pupils have made very satisfactory progress, and in the orders for work there has been a good degree of encouragement. Here, as well as in the Industrial Department before noticed, there is abundant room for the display of original talent and taste.

Independently of the constant demand for wood engraving and lithography, for the illustration of works treating on the arts and sciences, and on natural history, there are great outlets for labor in this branch in the embellishment of our periodical literature, and the Committee anticipate that all the pupils who may perfect themselves in the knowledge of these arts, will command constant and well paid employment.

The general arrangements of the School are of the most liberal and comprehensive character.

It has been deemed desirable to instil into the minds of the pupils that, while its doors are freely open to those whose circumstances render them unable to pay for instruction, yet in all cases where a reasonable fee can be paid it should be rendered by the pupil.

So soon as the instruction given fits a pupil for one of the applied departments, she is placed in it, and all her earnings, except a sufficient per centage, (retained to remunerate the School for the cost of the materials, and the use of the tools and implements,) are paid over to her.

The whole number of pupils admitted from December 3, 1850, to January 1, 1852, was 94, and on the last named day, 54 remained in the School.

The amount received for tuition fees to the same time, was $208, and for Designs, Engraving, &c., $448·25.

A particular account of the receipts and payments are herewith submitted in the account of the Treasurer of the School.

We have to regret that, owing to the failure of Messrs. Harnden & Co. to pay an order for forty dollars drawn on them, the proceeds of which were to be invested in the purchase of models, tools, &c., in Europe, we have been rather more limited in our means for instruction than we expected, but the knowledge and experience of our instructors have, to a satisfactory extent, supplied the deficiency.

As Mrs. Sarah Peter, (who is justly entitled to be deemed the founder of the School,) was about to visit Europe, the Committee requested that she would make an examination of the several Schools of Design established there, and on her return report their condition and management, so as to enable us to modify the arrangements of our own School, should we be found deficient in any essential particular.

In order to give to her introduction to such institutions the weight of an official sanction, a formal letter was prepared and delivered to her, under the seal of the Franklin Institute, requesting all in charge of such establishments abroad, to recognise her as the agent of the School, and to further the usefulness of such institutions by a full and free communica-

tion of plans and practical applications. No report has yet been received from her, but enough has reached us of the results of the visits she has already made, to prove that the intelligent philanthropy which suggested the founding of our School, will return to us clothed with an enlarged knowledge and renewed determination to make it quite equal to any she may have examined abroad.

Since the establishment of our School, one of the same character and objects has been opened in the City of Boston, and another has been, or is about to be, founded in the City of New York.

On the first of January last, the question of continuing the School for another year was decided affirmatively by the Committee, under a confident reliance that those who had already patronized the institution by their subscriptions, would again supply the means for its support.

Arrangements are accordingly in progress for a call on the liberal minded of our citizens, for the subscription of a sufficient amount to relieve the Committee from the individual responsibility assumed by them in the opening and maintenance of the School for the past year, and also for such additional subscriptions as will place it on a well endowed and permanent basis.

The grounds for the support of such an institution have been heretofore so thoroughly placed before the public, as to render it unnecessary to reiterate them in this report.

No one claiming a spark of philanthropic feeling, can witness the limited means at the command of women for obtaining a livelihood by labor, without a deep sense of regret, and a consciousness that something should be done to extend those means.

The field we have opened is almost limitless in its capacity, and will grow and increase with the increase of population and wealth. The small amount required for the annual support of such a school, is as nothing, compared with the great advantages flowing from it in a moral and social aspect.

The Schools of Boston and New York are reported to be already very handsomely endowed, and the Committee earnestly hope that the members of the Institute, and the public generally, will, by a visit to the School, and personal examination into its claims and merits, satisfy themselves of its importance and value, and immediately place it, by the liberality of their contributions, on a sure and permanent basis.

Assuming the expenditures of the past year as a basis, and estimating that the receipts for tuition and for work done, will somewhat exceed the amount derived from the same sources in the year 1851, the Committee consider that the sum of three thousand dollars will be wanted for 1852; and for the purpose of procuring said amount, and also for permanently endowing the School, they recommend the adoption of the most energetic measures.

School of Design, Feb. 10, 1852.

S. V. Merrick,
D. S. Brown,
F. Fraley,
Sarah V. Merrick,
Mary Lawson,
} *Committee.*

The Committee on the Library reported the regulations under which the pupils of the School of Design for Women will be permitted to take books from the Library of the Institute.

The Committee on the Cabinet of Minerals and Geological specimens, reported that the Heidelberg Collection of Geological Specimens presented at the last meeting, is arranged in the Cabinet, and open for the inspection of the members.

The Trustees of the Elliott Cresson Fund, presented their annual report.

The special committee, appointed to memorialize the City Councils on the security of buildings from fire, and to ask of the Legislature the passage of laws in relation to the construction of buildings in the City and County of Philadelphia, with regard to ventilation and light, reported on the subjects.

Resignations of membership in the Institute (2) were read and accepted.

New candidates for membership in the Institute (21) were proposed, and the candidates (15) proposed at the last meeting were duly elected.

The Standing Committees for the ensuing year were nominated by the President, and appointed as follows:

On the Library.

John Allen,
Spencer Bonsall,
James H. Cresson,
George Erety,
George W. Farr,
Wm. S. Levering,
William A. Rolin,
Jacob D. Sheble,
Clement W. Smith,
Dr. Geo. J. Zeigler.

Cabinet of Models.

George Ashmead,
Job Bartlett,
Harman Baugh,
Henry Huber, Jr.,
Lambert Keating, Jr.,
Henry Newsham,
Charles J. Shain,
John H. Towne,
James A. Wimer,
Charles Welsh.

On Exhibitions.

John Agnew,
John E. Addicks,
H. P. M. Birkinbine,
John C. Cresson,
Geo. W. Conarroe,
Owen Evans,
William T. Forsyth,
William D. Parrish,
Geo. W. Smith,
Alan Wood.

Cabinet of Minerals and Geological Specimens.

John F. Frazer,
Wm. W. Fleming,
Andrew Mayer,
Angus N. Macpherson,
Dr. B. Howard Rand,
Percival Roberts,
Charles E. Smith,
Dr. L. Turnbull,
John C. Trautwine,
Dr. Chas. M. Wetherill.

On Meetings.

Joaquim Bishop,
George N. Eckert,
Robert Frazer,
J. Vaughan Merrick,
Dr. B. Howard Rand,
Geo. W. Smith,
Chas. E. Smith,
John C. Trautwine,
Dr. L. Turnbull,
Dr. C. M. Wetherill.

Cabinet of Arts and Manufactures.

James C. Booth,
Joseph J. Barras,
Charles M. Ghrisky,
William Harris,
Henry H. Kelley,
William P. Troth,
Gustavus L. Thomas,
Eliashib Tracy,
Isaac S. Williams,
Thomas J. Weygandt.

On Meteorology.

Samuel W. Black,
Dr. Silas S. Brooks,
Charles M. Cresson,
Edmund Draper,
Owen Evans,
L. C. Francis,
Dr. David Gilbert,
James A. Kirkpatrick,
Dr. James A. Meigs,
Charles S. Rand.

Dr. Rand, Chairman of the Committee on Meetings, exhibited a model of a new form of artificial leg, the invention of Mr. Jonathan Russel, of this City. Its peculiarity consists in its possessing but a single spring, the power of which, by an ingenious arrangement of attached cords, is made to give the requisite motion and elasticity to the several joints.

In the thigh piece of the leg is attached a cord, which passes down in front of the bolt of the knee joint; in the body of the leg piece, this cord is attached to a spiral spring, from the lower end of which proceed two cords, which pass around a pulley situated just above the ankle joint; one of these cords is attached to the inner and upper side of the foot-piece, while the other, passing under the tenons of the ankle and toe joint, is inserted on the under side of the latter.

Connected with the spiral spring is a bent lever, so arranged that when pressure is made on the toes or heel, its shorter arm is thrown into a notch in the thigh piece, and thus motion in the knee joint prevented, and the leg rendered steady.

Dr. Rand also presented to the notice of the members, an improved apparatus for boring rock, the invention of Mr. John Thomson, of Kensington. The boring rod is attached by a swivel joint at its upper end, to a flat rod twisted at right angles on its own axis, and working through a frame. By drawing up this flat piece, a rotating motion is given to the boring rod, the degree of which may be regulated by adjusting the guiding frame.

Mr. Jonathan Russel exhibited a machine of his own invention, for turning irregular forms to pattern. The three preceding inventions have been submitted to the Committee on Science and the Arts.

Dr. Turnbull brought before the Institute, a very fine specimen of a true delft vase, presented by Messrs. Tyndale & Mitchell, to the cabinet of the Institute. The vase possessed all the characteristics of the true delft ware, being of soft pottery, almost as light as wood, very beautifully ornamented with delicate painted flowers, with leaves and fruit in relief. Dr. Turnbull stated that this kind of pottery was made in Holland, in the 15th century, as a true delft tile in the cabinet has that date upon it, and that the Dutch ware, made at Dalft, was called the parent of pottery. It is the most celebrated, not only on account of its singularity of form and color, but also for its excellent qualities; it is remarkable for the beauty of its enamel, which is not a shining white, but slightly tinged with blue, and presents a smooth and even surface, allowing ornaments of every color to be placed upon without disturbing the enamel, or impairing the brilliancy or distinctness of the colors. The prevailing color is blue, like the tile in the cabinet. The articles of delft ware manufactured for ornaments were chiefly copied from the old Japan porcelain, both in form and color. The hideous imaginary animals of the chimœra class; the three-ringed bottle, the tall and shapeless beaker, and the large circular dish, may still be seen in most collections of Dutch delft. It is to the introduction of the fine English wares, as well as of oriental porcelain, which came into general use in the 17th century in Europe, that the decline of the manufacture of fine pottery is to be attributed. The complicated forms, the fine and delicate paintings required, enhanced too much the price of a ware, of which the materials was less esteemed than that of the new sort which then appeared, so that the fine enamelled, soft pottery ceased to be made in the 17th century, and the manufacture degenerated to very ordinary ware.

Dr. Turnbull also presented to the meeting a specimen of a brick from

the Coliseum at Rome, which Lieut. Stellwagen, U. S. Navy, kindly presented for the cabinet of arts and manufactures of the Institute.

Mr. I. W. P. Lewis, C. E., submitted to the meeting two models, representing a new method of constructing foundations for light-houses, piers, &c., exposed to the force of the sea; also a number of drawings of celebrated light-houses. In describing these, Mr. Lewis demonstrated that there are but two methods of erecting permanent structures of this character; 1st, by opposing "*strength*" to the shock of the sea, as in the case of screw pile foundations; and 2d, by opposing "*weight to weight*," as in the Eddystone, Bell Rock, and other towers.

The stability of all these solid structures is due to their weight, and not to the curvilinear outline, of which so much has been said. Mr. Lewis considered these curved outlines as a useless refinement, and demonstrated the frustum of a cone to be the solid of greatest stability for such purposes. The Bell Rock light-house, he considered as a caricature of the Eddystone, the curved base being carried some five feet beyond the line of pressure of the superstructure. The Skerryvore light-house is another striking example of curved outline, more absurd than any one of the kind. The curve of this tower is a hyperbola, and the cost of executing it in granite, must have added a very large sum to the extravagant cost of the tower. The only reason offered by the architect for adopting this in lieu of a simple conical frustum is, that it would bring the centre of gravity of the tower about "*two feet*" lower.

Mr. Lewis exhibited a drawing of the second Eddystone light-house, erected by John Rudyerd in 1706, as a satisfactory example to prove that weight and simplicity of form are the requisites to ensure stability. Rudyerd's light-house was built of wood in the form of a conic frustum, 61 feet high, 22 feet 8 inches diameter at the base, and 14 feet 3 inches diameter at the top. The timber used was the best of oak, laid stratum superstratum, and ballasted at three intervals with about 356 tons of granite; the strata of ballast being separated by courses of timber. The base was secured to the sloping rock, by cutting horizontal benches thereon, and inserting in the rock, stout iron anchors, the upper parts of which were bolted to the timber. The surface of the tower was formed of upright timber, 9 by 12 inches square, bolted to the interior work, and caulked and pitched like the seams of a ship. This light-house, the construction of which, "Smeaton" eulogizes in very strong language, withstood the fury of the ocean for 46 years, and was then destroyed, not by water, but by fire, being burnt down in 1755.

The present Eddystone light-house, erected 1756-9, by John Smeaton, is a fine specimen of masonry, and is justly looked upon as one of the most remarkable structures in the world; but Smeaton does not give any satisfactory reasons for adopting a curved outline, though this was doubtless suggested to him by the sloping surface of the rock on which he was to build his tower. The building is small, being only 68 feet high, with a diameter of 26 feet on the lowest complete course of the masonry, and 15 feet diameter at the top; its weight is 1817 tons, and the force of a heavy sea falling on its surface at high water, would probably be about 1200 tons, allowing this force to be 6000 lbs. upon a square foot.

The models designed by Mr. Lewis, consisted of a series of cast iron

blocks, moulded into peculiar dove-tailed forms, by means of which several very great advantages are obtained; 1st, a "*vertical band;*" in structures of stone, "horizontal band" is easily obtained, so that each course of masonry may be united as one stone. Such is the peculiarity of Smeaton's Eddystone. But to obtain vertical band in stone masonry, would be attended with extravagant cost and much difficulty. The advantages of such a band are, that during the erection of a tower, none of the blocks could be dislodged from their beds, by any force of the sea, however great this force might be; and when complete, the tower would resist any force on the upper part, tending to break and overthrow it, with the whole strength of its material.

2d, By using cast iron in place of stone, nearly three times the weight is concentrated in each cubic foot of material. Mr. Lewis exhibited a design for a light-house tower, 90 feet high, 25 feet diameter at base, and 14 feet diameter at top; the first 40 feet constructed of two concentric courses of cast iron blocks, dove-tailed together vertically and horizontally, the interior void filled with concrete, and the mass weighing 1531 tons. The superstructure of the tower consisted of cast iron plates lined with a course of brick work, weighing altogether 250 tons, making a total of 1781 tons. The force of the sea striking against the lower 32 feet of the tower, at the rate of 6000 lbs. per square foot, would be 1138 tons, leaving 643 tons surplus weight for the stability.

Discussion took place as to the means of protecting these iron towers against corrosion, &c. Mr. Lewis mentioned the various methods that had been tried, did not consider any of them perfectly satisfactory, but thought (unless a part of the structure was constantly under water,) the iron could be secured against injurious decay. Mr. Tilghman suggested the patent method of coating the iron with fused silicious sand at the moment of casting, which forms a rough but perfect glazing over the iron, and is of course impervious to water.

BIBLIOGRAPHICAL NOTICES.

Appleton's Dictionary of Machines, Mechanics, Engine Work, and Engineering.

Since our former notice of this work, in which we took occasion to express our opinion that the explanation given by the Messrs. Appletons for their omission of Mr. Byrne's name from the title-pages of the book of which he was publicly proclaimed the editor, was unsatisfactory; we have received a letter from Mr. Julius W. Adams, which, after explaining the whole circumstances of the case, closes as follows: "I repeat, *that I, and I alone, superintended, wrote, and collected, collated, composed, examined, and prepared for publication, the second volume of Appleton's Dictionary of Machinery.*" By referring to the January number of this Journal, our readers will see that this makes a direct issue with Mr. Byrne's statement, and the character of Mr. Adams, as well as the well known respectability of the firm of Appleton, entitle him to credit for his assertion. In reference to our final query, it is stated that the first title-page of the second volume

the Coliseum at Rome, which Lieut. Stellwagen, U. S. Navy, kindly presented for the cabinet of arts and manufactures of the Institute.

Mr. I. W. P. Lewis, C. E., submitted to the meeting two models, representing a new method of constructing foundations for light-houses, piers, &c., exposed to the force of the sea; also a number of drawings of celebrated light-houses. In describing these, Mr. Lewis demonstrated that there are but two methods of erecting permanent structures of this character; 1st, by opposing "*strength*" to the shock of the sea, as in the case of screw pile foundations; and 2d, by opposing "*weight to weight*," as in the Eddystone, Bell Rock, and other towers.

The stability of all these solid structures is due to their weight, and not to the curvilinear outline, of which so much has been said. Mr. Lewis considered these curved outlines as a useless refinement, and demonstrated the frustum of a cone to be the solid of greatest stability for such purposes. The Bell Rock light-house, he considered as a caricature of the Eddystone, the curved base being carried some five feet beyond the line of pressure of the superstructure. The Skerryvore light-house is another striking example of curved outline, more absurd than any one of the kind. The curve of this tower is a hyperbola, and the cost of executing it in granite, must have added a very large sum to the extravagant cost of the tower. The only reason offered by the architect for adopting this in lieu of a simple conical frustum is, that it would bring the centre of gravity of the tower about "*two feet*" lower.

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